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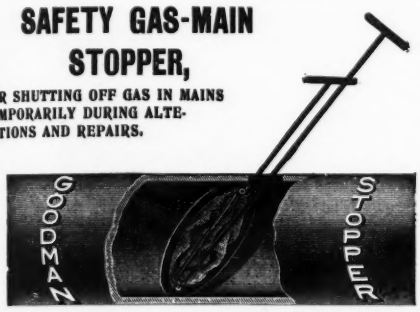

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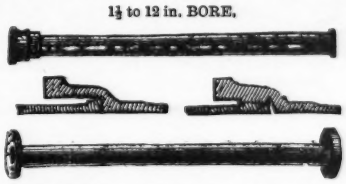

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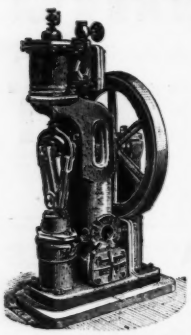

Fig. 705. "SINGLE RAM" STEAM-PUMP.

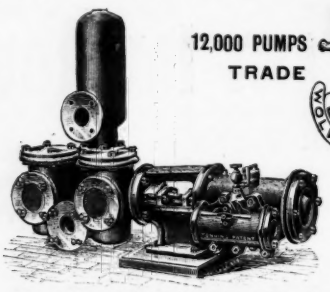

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

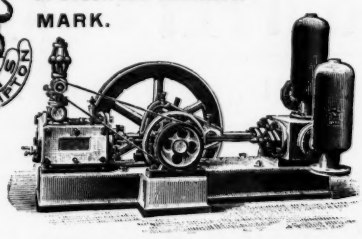

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

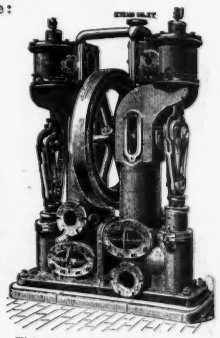

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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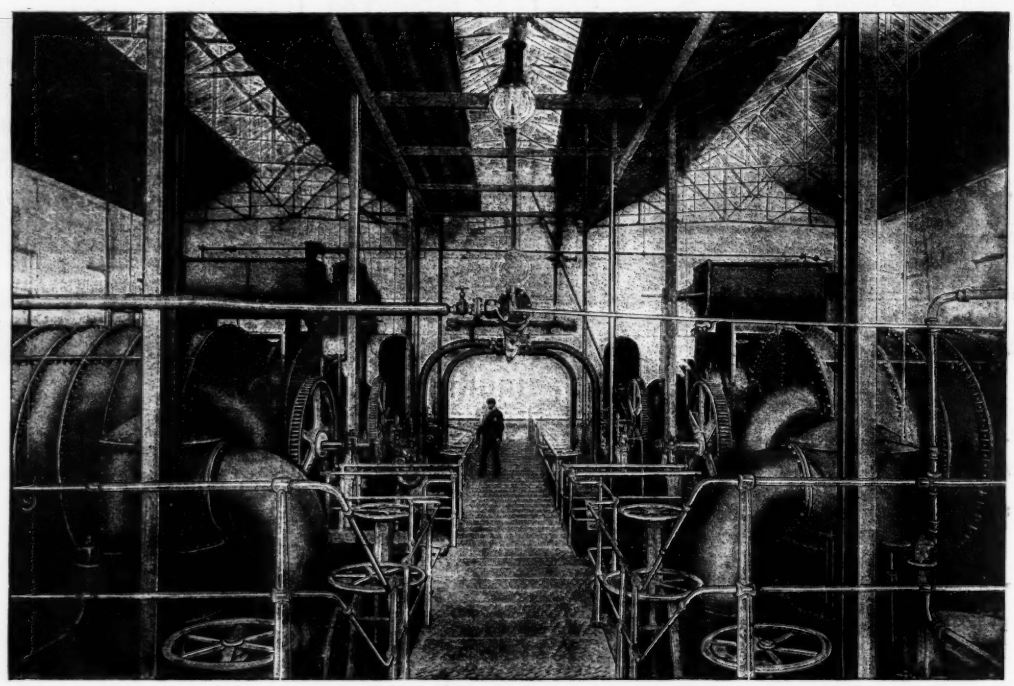

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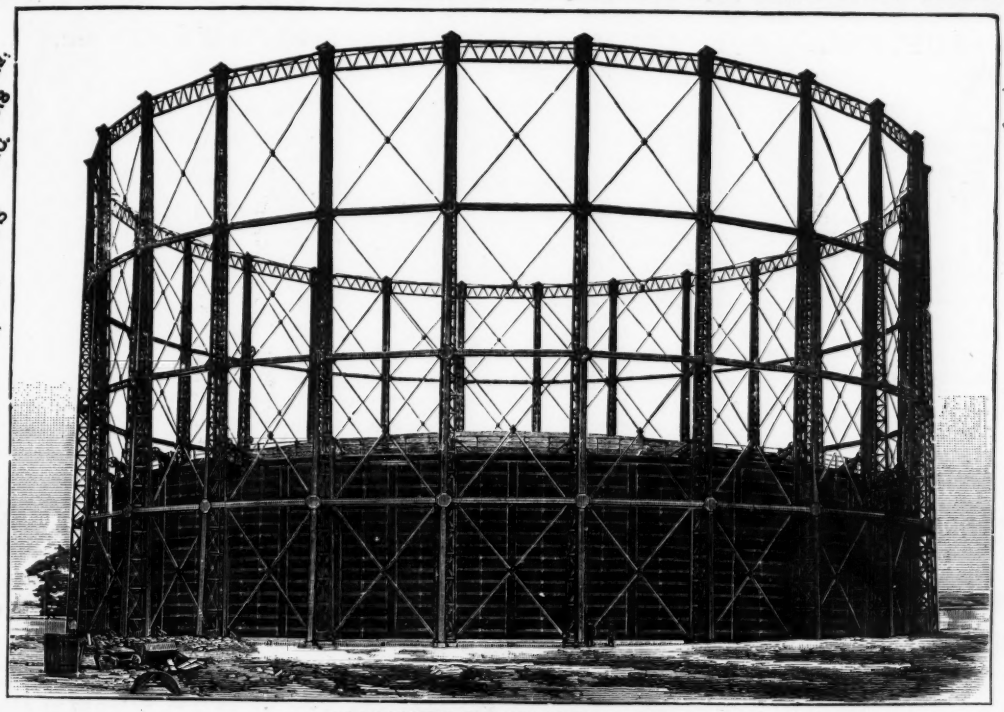

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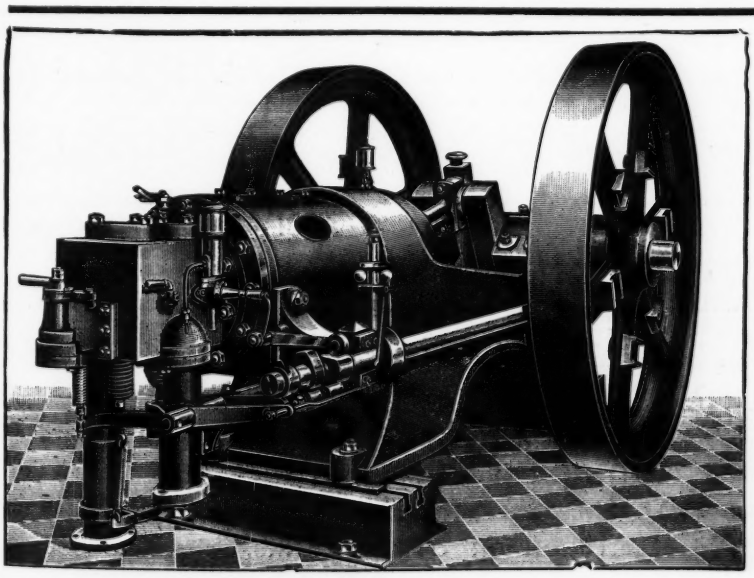

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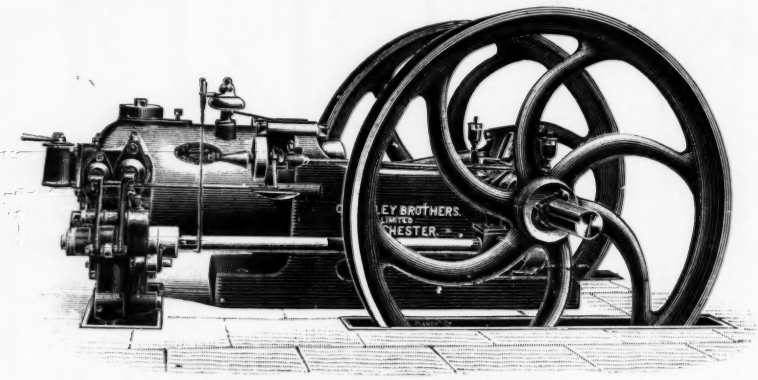

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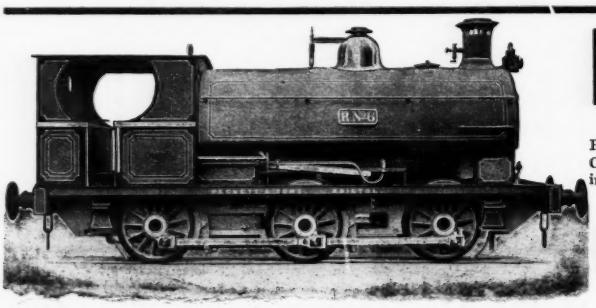

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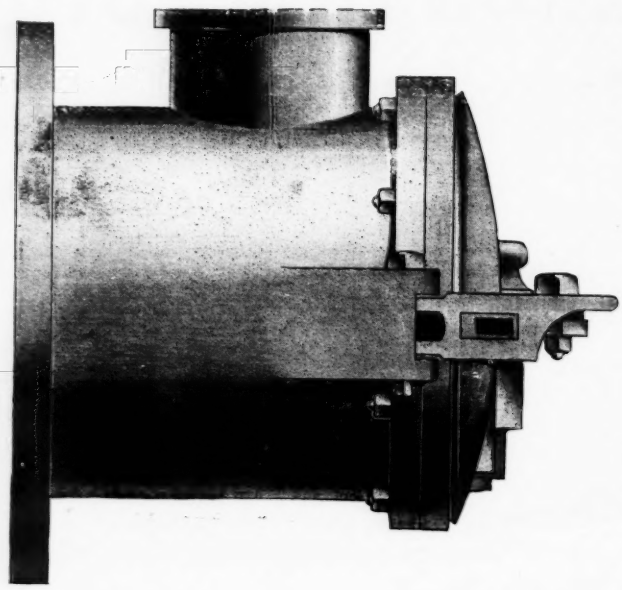

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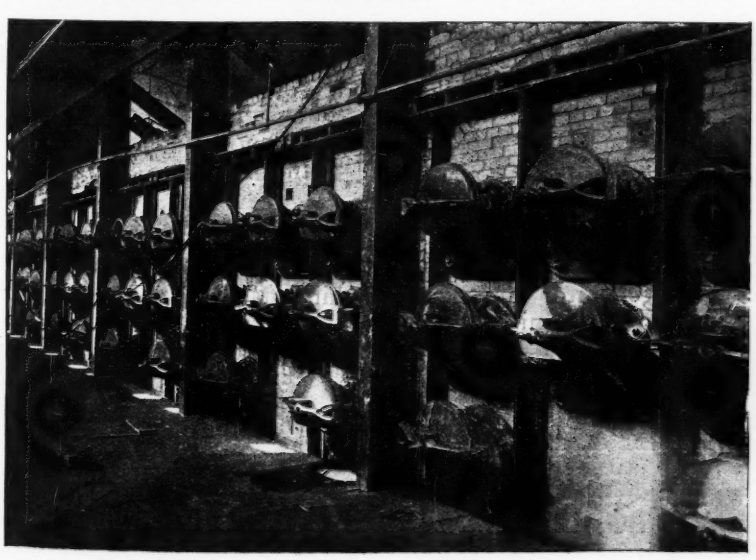

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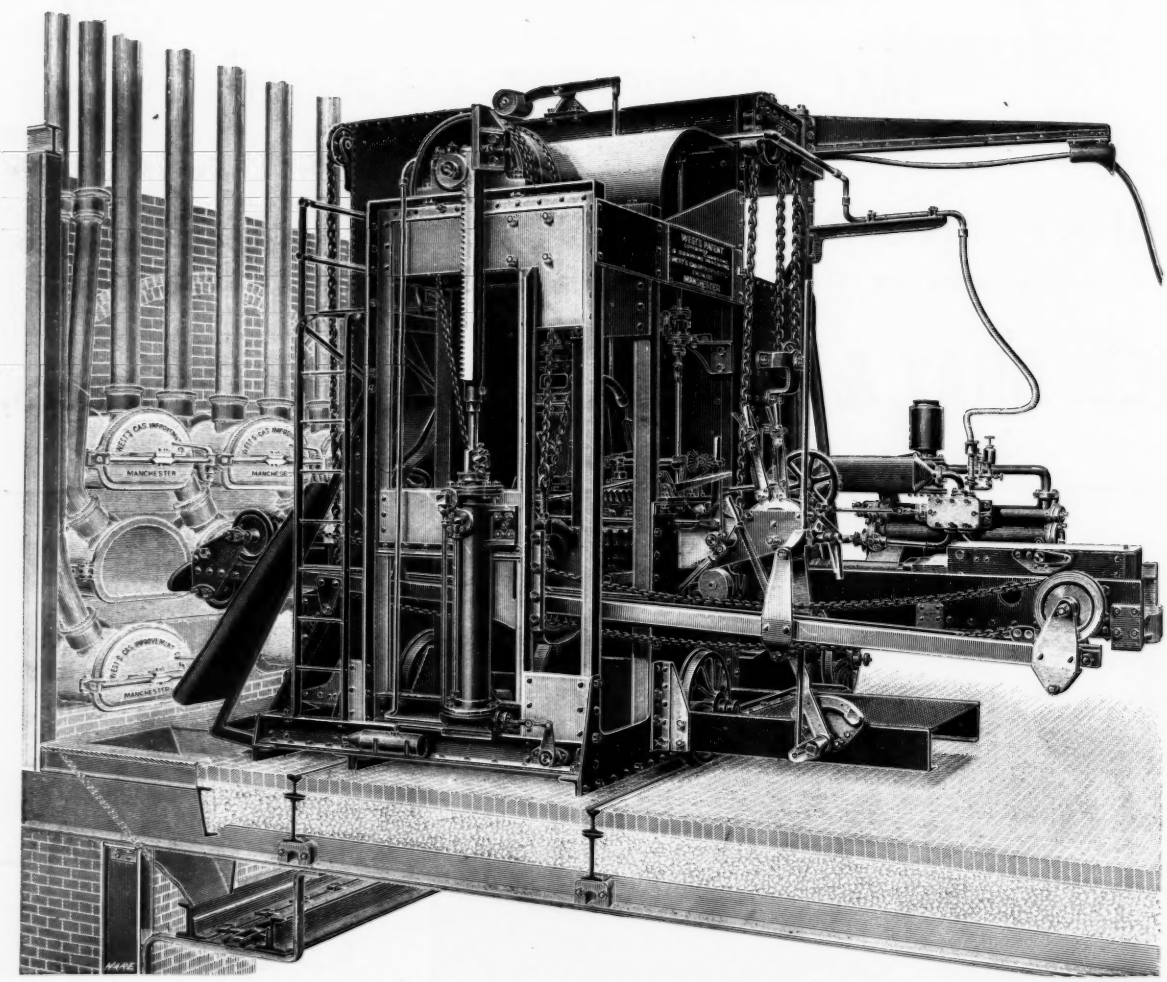

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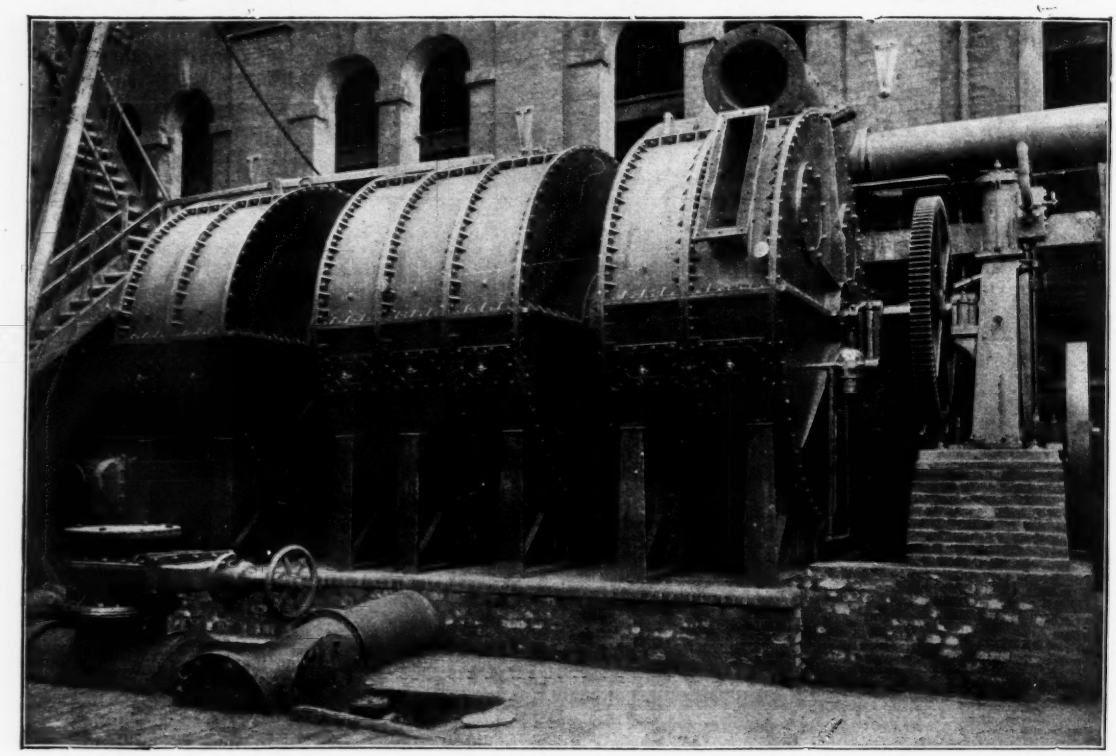

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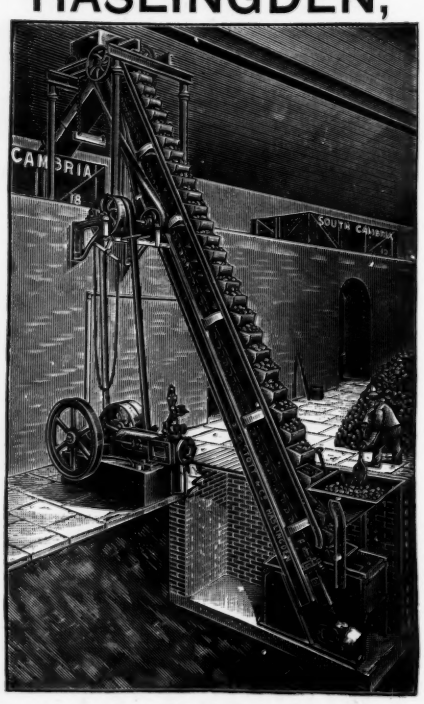

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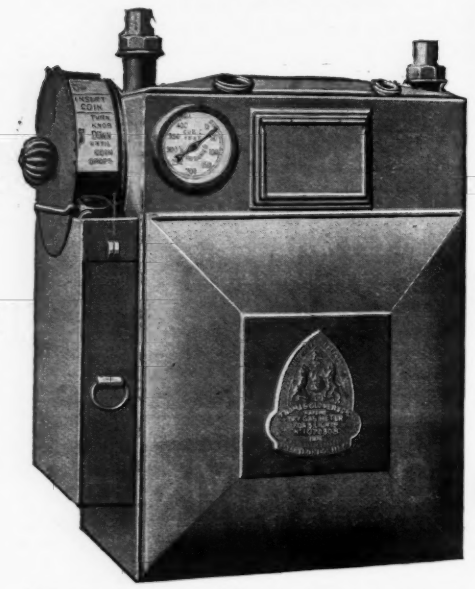

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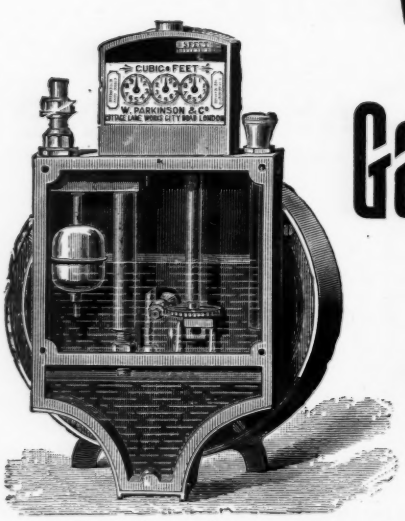

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EDITORIAL NOTES.

Mr. Glasgow Praises Carburetted Water Gas.

THOSE of Mr. A. G. Glasgow's friends in this country—a numerous band—who may have been anxious on the score of his health, have now the best of all possible assurances that the doughty champion of carburetted water gas is in the full enjoyment of his remarkable powers and gifts of exposition. In another part of the "JOURNAL" will be found the text of a long and most interesting paper read by him before the American Gaslight Association on the 21st inst., which exhibits in full luxuriance the author's inimitable controversial manner. As his countrymen would say in their terse phraseology, there is "nothing the matter" with a man who can romp through a very difficult technical question as Mr. Glasgow has now done, not for the first time. We have to observe at once, on this paper, that it is not our present intention to discuss it. It must stand as an entertaining as well as instructive addition, thoroughly up to date, to the literature of the subject. Perhaps in a little time it may appear expedient to quarry into the impregnable rock of Mr. Glasgow's treatise, with the object of bringing into the light of another day some of his gems of observation and reflection. For the present, the very bulk of the paper is an insuperable obstacle to anything like an adequate critical or appreciative notice of it in these columns. It would obviously be discourteous in the extreme to treat so eminent an expert as Mr. Glasgow otherwise than in his own fashion, which is tantamount to saying at quite equal length. Indeed, it is usually found that the reply to an opening of this character takes up more space than the original provocation; while journalistic controversies notoriously have a tendency to get more long-winded at every stage. Therefore, with all due respect to Mr. Glasgow, we must refrain from traversing his latest confession of faith, either to register agreement with some of its points or objection to certain others. We simply cannot find the requisite amount of space to argue with him to the exhaustion of the subject, and will not attempt to deal with his matter piecemeal. In point of fact, his essay is homogeneous, and hangs together as completely as—well, as the old song entitled "The Leather Bottell!" To pick it all to pieces, before it had served its purpose, would be simply to spoil it. Such artistic work deserves more respectful treatment, and the requirements of the occasion are satisfied by the reproduction of the text, and its hearty commendation to the careful attention of British gas engineers.

The Midland Association at Walsall.

FOR the first time in their history, the Midland Association met at Walsall last Thursday. We do not know whether to blame Walsall or the Association for the neglect the one of the other. It is almost unpardonable, seeing that between the two there exists a happy tie. It was the former Engineer of the Corporation gas undertaking, Mr. John Tindall, who more than twenty-six years ago uttered the words that a little later brought into being the organization. The incident was referred to by Mr. Charles Hunt at the twenty-fifth anniversary twelve months ago; and it would have given the members extreme gratification to have had their old friend in their midst on this occasion. However, though the Association has not hitherto been honoured by Walsall, nor Walsall by a visit of the Association, both made up for lost time on Thursday; and between the Corporation and the Association a lasting friendship has been established. Every kindness was shown to the visitors by the Mayor (Alderman J. Noakes), the Chairman of the Gas Committee (Alderman T. P. Browning), his colleagues, and the Corporation Gas Engineer and fellow-member (Mr. B. W. Smith). The members of the Association on their part responded to the invitation to Walsall in large numbers; and they appreciated very highly all that was done for their technical and personal pleasure.

The programme for the occasion was one that was altogether out of the common for the autumn meeting. Papers and discussions were eschewed; the Corporation Gas-Works at the Pleck, which have been remodelled and equipped with a variety of new labour-saving and other plant since Mr. Smith has taken them in hand, furnished much more substantial interest than several papers could have done. There has been a complete transformation of these works within the past three years; and it would now be no easy matter, as the President (Mr. Charles Meiklejohn) and other members found an opportunity for pointing out, to find a gas undertaking of a like capacity that could to-day transcend those at Walsall in attractiveness for the gas engineer. The full account of the objects of interest which appears elsewhere, together with the series of articles published last year, having these works for their subject, leave nothing to which we can profitably direct further attention here. It must, however, have struck the many engineers present, as it has previously done us, that Mr. Smith has been very generously seconded by his Committee in his efforts to bring their works—it was indeed a complex job—round to modern ways of producing efficiency and economy. Already the financial results have fully justified the confidence the Committee have reposed in their Engineer.

At the brief business meeting which preceded the visit to the works, the President introduced the question of making a donation of 25 guineas to the Benevolent Fund of the Institution of Gas Engineers; and the sum was readily voted. Other District Associations who have any surplus cash lying at their bankers could not do better than emulate the action of the Midland Association. The elections which followed this piece of benevolence have advanced several of the members into the responsibilities of office. Mr. George Helps, of Nuneaton, will succeed Mr. Meiklejohn when he resigns the chair next year; and Mr. Thomas Berridge, of Leamington, follows Mr. Helps in the Vice-Presidency. The nomination of these gentlemen for their respective positions was very heartily applauded and ratified. The only other item on the *agenda* for this part of the day's proceedings was the reading by Mr. B. W. Smith of a brief sketch of the development of the Corporation gas undertaking, which brought the members (as it were) up to the point at which they were to commence to see for themselves what is being done to further develop the concern. There was only one paragraph in the paper which went outside the main subject; and in it is reflected the equanimity with which Mr. Smith contemplates the approach of the competition of Mond gas in the borough for power purposes. From what he says, it is manifest that Walsall will not, or rather cannot, contribute much towards recompensing the Mond Company for their heavy outlay. The success of last Thursday's change from the ordinary course of an autumn meeting of the Association supplies an excellent precedent for the Committee—not for frequent, but occasional, following, because the works that contain such a variety of interest as those at Walsall are few and far between.

The Sale of Power at a Discount.

IT is with much pleasure that we welcome the thoughtful letter of Mr. J. W. Napier, of Alloa, on the selling of electric power at a discount. We felt sorry that a previous discussion of the application of the same principle to the sale of gas for power purposes died out as it did, without the emergence of any definite rule in the matter. Perhaps now the subject has been revived we shall hear something more about it. For whether one likes the prospect or not, the problem is with us, and has come to stay. The present letter of Mr. Napier is very interesting for several reasons. For one thing, he is in the position which we have so much desiderated for gas managers in small towns and districts, of having the two sides to his shop. This is a great advantage for the local public, who know that they will be served with either gas or electricity according to the respective merits of each, and in obedience to their own wants and wishes. Odd as the contention may strike one at first sight, it is nevertheless arguable that a

capable and thoughtful gas manager, with good commercial aptitudes, will probably do better with an electricity supply branch than a mere electrician, whose training has been purely scientific. It is not at all necessary for the manager to be an expert in electricity in order to sell it. Indeed, he had almost better not have volts and amperes and phases running continually through his mind, which should have more room in it for thought of the consumer than electricians are apt to allow. But be this as it may for a generalization, one may be sure the consumers of either gas or electricity, or both, in Alloa are safe in Mr. Napier's hands.

We can shake hands with Mr. Napier heartily on the point of not being guided exclusively by the rule of averages. This is one bit of common ground gained since the last time the subject was ventilated. We are not quite certain whether we can follow him in his particular classification of the charges that compose the cost of electric energy generated at a central station. He appears to be a little too liberal with his list of standing charges. With all the diffidence proper to be shown by those who, not possessing electrical engineering experience, yet venture on the criticism of electricity generation accounts, we would ask whether a proportion of the wages, also of the repairs and maintenance and the rates, are not really expenses of generation. The difference may not be great; but one should be careful to accurately distinguish between real standing charges and those which are apparently of the number. Clearly, in the case of an electricity generating station, the ratio of real standing charges to those which rise and fall with the amount of electric current generated, is fairly large. This comes out very plainly in Mr. Napier's own words, where he mentions the case of the supply being constant and uniform for one hour per day throughout the year, as a maximum. Everything has to be made ready for this, after which the actual additional expense of running the machines is very little. It is stated that the price to the Corporation for the supply in bulk is £9 per kilowatt of maximum demand, and 1½d. per unit, which works out to an average of 3·65d. per unit purchased. This cannot be called dear. It is satisfactory to notice that Mr. Napier, in reckoning his profit on power supplies at 2d. per unit, computes it on the selling price, not on the cost. This is, of course, the proper way to strike a profit; but it is not every commercial man who follows the rule. Mr. Napier's correctness in this particular inspires confidence in his general figures.

It is to be hoped that he will forthwith address himself to the further effort indicated in the concluding sentence of his letter, and consider the claims of gas-power users to secure a substantial discount on the selling price of lighting gas. He is probably justified in holding that, in order to compete with producer gas manufactured by power users on their own premises, ordinary gas would require to be sold at a price not more than 1s. per 1000 cubic feet. That is to say, if equivalent calorific power only is to determine the relative values of the supplies. There may be other considerations in the case, which might induce the purchaser of power gas to pay a little more for it than the equivalent in producer gas would cost. Say, at any rate, the price of competing power gas from the town mains must be cut to 1s. 2d. per 1000 cubic feet. This has been our position all along. The next question is, whether any gas undertaking should "face the music" on these terms, while the selling price of lighting gas averages perhaps 2s. 6d. per 1000 cubic feet. Or should the ordinary gas undertaking give up the hope of meeting this kind of competition? This is the problem that now lies right before the gas industry of the United Kingdom in various and sundry localities. It is by no means one that can be answered off-hand. Of course, there is another way out of the difficulty, which lies in the manufacture and supply by the gas undertaking of producer gas. This plan, however, is beside the immediate and most pressing question, upon which we shall be glad to hear Mr. Napier and every other equally well-qualified manager of a light, heat, and power supply undertaking.

Gas and Artistic Fittings.

From time to time the topic of street lamp-posts comes up for mention in these columns—mostly, it is to be feared, in unfavourable terms. The English people are, as they confidently believe, in the forefront of the march of civilization; and, conscious as we may be of each other's shortcomings, we do not like other nationalities to tell us of them. Yet there are some matters in regard to which almost any country in Europe could give us points and a beating; and the artistic treatment of our streets is one of them. There is no denying the fact that the usual British lamp-post is an abomination, more especially the sort which make some pretence to being decorative. English ironfounders can produce plain, serviceable, inoffensive lamp-columns, suitable for ordinary use anywhere; but it is when the character of the location seems to call for something special that not the founders, but the designers, go astray. It is hardly too much to say that the whole English-speaking world is now watching with interest the process of reconstructing the Strand at the hands of the London County Council, and under the auspices of the Corporation of Westminster. There are certain things and places in London which are more than Metropolitan, if one could find a word for the idea. That is to say, they belong to the perceptions of the civilized world. The Strand is in this category. There are, of course, many much finer thoroughfares, both in England and abroad; but the Strand, with its two churches irregularly posed in the middle of the traffic, is unique. It is with doubts and fears that people watch the doings of the Local Authorities of the moment in the place which they might easily spoil, but can scarcely improve, in the proper sense of the word. Already they have made a sort of aneurism in the street; and it will be something to be thankful for if, when all the programme as at present projected is carried out, the result is not a chill disappointment.

In the meantime, the Corporation of the City of Westminster are erecting new electric arc-light columns in the already widened street. And such columns! Huge things with a square base which looks weak in relation to a bulbous shaft, of the "leek" pattern, which starts from a flat square capping, admirably adapted to serve as a perch for active loafers to view processions from. These perches are going to give the police trouble some day soon. It has been understood that one of the points of good lamp-post design consists in the absence of projections likely either to assist climbers or to form a standing-place. Whoever designed the new Westminster lamp-posts overlooked this common-sense requirement. Not long ago there was a competition for lamp-post designs, organized by the "Studio;" and we reproduced the drawings and criticized them from the technical standpoint. When one of our local authorities happens to want a design for a thing of this order, do they ever think of the artists longing for employment, and give them an opportunity for showing what they can do? Not at all. They get from "firms" tenders and designs sent in at a few days' notice; or a sketch may be got out to order in the Borough Surveyor's office. This is not the way to get really good work done in this line; and it could be largely corrected by the exercise of a little forethought.

By the way, the designs for electric light fittings, both external and for interiors, are showing great improvements with every successive season. Not only is a very striking freedom being displayed in the lines of these fitments, but the new materials used in their construction betray the existence of a spirit of unconventionalism which is calculated to take the public eye. Makers of gas-fittings will need to brace themselves to meet this form of competition. The old-fashioned bright brass, bronze, and black finishes for gas pendants and brackets look altogether dowdy beside the silver-pewter, copper, and bright steel of the electric lamp fittings. Something must be done so as to place incandescent gas abreast of these really artistic devices; and if the suggested gas exhibition under the auspices of the Institution of Gas Engineers ever comes off, a good and original art competition, for trained handicraftsmen, should form one part of the programme. What is wanted is to get at the individual worker in metals, and not leave everything to firms and companies. Once more we are constrained to ask: What are the Corporations doing in this matter? It is reported, for instance, that the Northern Art Workers' Guild have just held an exhibition at the Municipal School of Technology, Manchester. There were candle sconces shown on this occasion; but no gas bracket or lantern, for a Corporation prize. It is idle to sit still and watch all the artistic feeling of the country passing by gas—giving it a wide berth or ignoring it altogether—and enhancing the attractiveness of other means of lighting. It will be too late to complain after the mischief is done, and people will not look at gas because the fittings have not been kept up to the artistic standard of the times.

The Conditions of Labour in the United States.

A REFLECTIVE article on the issues between Capital and Labour in the United States, by Mr. Egbert P. Watson, appears in the contemporary number of the "Engineering "Magazine;" and it may be commended to the attention of those British employers and others who have been overdosed of late with newspaper eulogies of the industrial situation in America. Whatever else may be true of industrial conditions in the United States, such as the abundance and cheapness of raw materials and the enormous home markets for manufactured goods, it is plainly declared by Mr. Watson, who writes with some authority, that labour is thoroughly disorganized. One working man's hand is raised against another, and all, or a very large portion, are arrayed against their employers. Mr. Watson confesses to having been defeated in every attempt he has made to find a remedy for this state of things. The chief source of the evil is the Trade Unions. Some twenty years ago, before Labour in the States was "organized," the workmen were free agents, choosing their own shops and employers, and were in the main orderly, well-behaved, useful citizens. They did a fair day's work for fair wages, and employers dealt directly with every individual according to his merits. The system worked well, and there was no dissatisfaction with the results; but as soon as "organizations" arose in the land, trouble came, and has continued to this day.

Mr. Watson confidently believes that if American workmen were free to choose between allegiance to an employer and subservience to a Union, with all its impositions and taxes, the Union would be voted out of existence. And this from the Land of the Free! He admits that newspaper reports differ from him; but he asserts that these do not express the opinions of the workmen, only of those who hold them in bondage. The forces by which this tyranny is being effected in what is theoretically a free country are personal violence and ostracism. The remedy for such a subversive and unconstitutional state of things is hard to find. Benevolence, model conditions of employment, are no good. Profit-sharing is equally ruled out; for the reason that the benefits of the system are too small for the individual workman, who is, besides, indoctrinated with distrust of his employers and all their agents. The 'fore-mast hands, in short, are always in a state of active or potential mutiny against the after-guard. Nor does Mr. Watson believe any more in the last refinement of profit-sharing—copartnership. He regards all such arrangements as co-operative concerns, with all the disabilities of the genus. "Co-operative shops consist "usually of a force where every man is boss; then chaos "comes again."

Having talked the subject up and down with intelligent workmen and employers as well, from the general consensus of opinion Mr. Watson concludes that the men object to be "personally conducted" to the Land of Plenty and of Contentment. They have a preference for finding their own way thither, even if this leads them, as it usually does, in a totally wrong direction. Something unique seems to have been done in Chicago. Employers in various trades, and the workmen, have come to a mutual agreement to "pool their issues." The capitalists find the money, as they always have done, and the workmen do the work at their own prices and likewise at their own convenience. The coalition is a very close corporation, and no outsiders have a chance of "getting a look in." The coal dealers, for example, employ none but Union men; and the latter will only work for members of the Coal Dealers' Society. The public pays. The whole scheme is illegal—being in restraint of trade. This consideration, however, does not weigh anything in the United States to-day. The City of Chicago is so thoroughly mastered by the Unions that every industry is paralyzed. The Unions have doubled their membership in twelve months, and the increased wages they have exacted amount for the same period to £320,000. Mr. Watson asks what profit-sharing or copartnership device can show a record like this. Of course, it is highway robbery, with violence if necessary. Unless the whole tenor of history is to be disbelieved, such methods must come to an end sooner or later; but this consideration does not benefit those whose interests are suffering from these organized depredations of combined employers and workpeople. This is not the only respect in which systematic defiance of the law of the land has been exhibited as one of the ills of the body politic of the United States.

The Crystal Palace Exhibition.

The Crystal Palace Company have determined, notwithstanding the resolution of the Committee appointed by the Council of the Institution of Gas Engineers for the specific purpose of assisting to bring the projected Gas Exhibition to as successful an issue as possible, to persevere in making the best of it in their unaided power—they holding that they are now committed to the exhibition to an irretrievable extent, and that they have their obligations and the Council of the Institution theirs in the matter. This touches the whole point as far as the "JOURNAL" is concerned. We were among those who have worked for success; and one of the first moves made was to urge upon the Palace authorities to take the step which (we believed) was indispensable to success, and that was to secure the co-operation of the Institution. This being so, no one can accuse us of desiring to see at the Palace anything in the nature of a failure. But we cannot lightly shake off the view that a promise of support such as that entered into by the Council (and, mark this, so far as our latest information goes, not yet withdrawn, but as good as withdrawn by inaction) is a bond which, no matter what the event, should be honourably respected. The suggestion conveyed by the resolution of the Committee is rather appalling, that the influence, personal and collective, of the Council of the Institution with the manufacturers of gas appliances is so weak that the time from Sept. 24—the date on which they determined to do as much as possible to make the exhibition a success—to the middle of December was insufficient for a representative exhibition to be brought together. It is not within us to encourage such a thought. The attitude of the "JOURNAL" in connection with the matter is very clear; but it seems to be necessary to emphasize it. When the project was first brought to knowledge, inquiry was made to ascertain who were the responsible organizers; and the information was published. The next thing was to withhold any definite support until the Crystal Palace authorities had obtained that of the Institution; and thereafter our efforts were directed to aid the Institution in the responsibility that they had taken upon themselves. This position brought to us correspondence and personal inquiries from several manufacturers seeking advice; but no advice was given until the decision of the Council on the 24th ult. This should be sufficient to show that intelligence as to the possibilities of the exhibition was not confined to the information obtained from the Palace Exhibition offices nor from the Institution; and this will explain the ground for some of our remarks in last week's issue.

A Vindication.

Under the circumstances, it was a duty, when the letter addressed by instruction of the Committee—not by the Council—to the Palace Company's Organizing Commissioner, was voluntarily handed to us, to acquaint those interested in what was happening, and of the resolution of the Committee. We have been taken somewhat to task for what appears to be regarded as an enormity in publishing the letter; but we are quite willing to bear any disgrace (if such it can be called) attaching to the act of informing gas manufacturers, as early as possible, of the changed position of affairs, so as not to let them take further steps in ignorance of what might be before them through the action of the Committee, and in the event of the Council ultimately determining to accept their decision. Let those who condemn the publication consider the position from the whole of the manufacturers' points of view, and not entirely and selfishly from their own. Had the manufacturers not been acquainted with this unexpected proceeding of the Committee, many might have been committed (before the Council of the Institution had been consulted) to the acceptance of space at the Palace for the exhibition. As it is, there are those who previously to last Tuesday had engaged to take space on the guarantee afforded them by the patronage of the Institution. We do not know whether there are few or many who had reached this point; but if there was only one such, what are the obligations of the Institution to that one? During the week, communications on the subject have been personally made to us—we will be candid—by two or three such firms; and naturally they want to know their position. Will the Committee tell us whether the applications of these firms are binding, or whether the Crystal Palace Company will, in the event of withdrawal, if the Council accepts the resolution of the Committee,

have any claim on them or on—well, we will not father the suggestion that has been made to us, but leave the Council of the Institution to supply the alternative. We cannot look for anything now at the Palace in the way of an exhibition such as was anticipated, and such as might have been brought together—and we say it emphatically, after due consideration and consultation outside—by the active exercise of the influence of the Institution after the meeting on Sept. 24. The interest of the Crystal Palace Company is not our own, which lies solely on the side of the gas industry. The whole position is a confusing one; and that confusion would have been intensified by prolonging for a single week the publication of the Committee's letter. Whatever the Committee may think on the subject, it shows the frankness of the Organizing Commissioner in possessing no desire to keep even the unconfirmed resolution a secret as long as possible, and use the interval before its presentation to the Council to further his own ends under false pretences. Nor did he, we are also compelled to remark, suggest to us that any criticism should be passed upon it. The whole affair is a regrettable one; and very good reason will have to be shown to convince us that, in the circumstances, our action of last week deserves the reproof of anyone. We are perfectly satisfied with the judgment that has been passed upon that action outside the Committee.

The Manchester Institution and the Exhibition.

Since the above notes were penned, a letter has been received from Mr. H. Kendrick of Stretford, the Hon. Secretary of the Manchester District Institution of Gas Engineers, to the effect that the Committee have extended their patronage to the Exhibition. The resolution, which was passed by the Committee on the 13th inst. was: "That this Institution extends to the Crystal Palace Gas Appliances Exhibition its patronage, on the same terms as the Institution of Gas Engineers has done, but will take no monetary responsibility." Perhaps the Manchester Institution will feel disposed, under present circumstances, to back up their patronage by a little activity among their friends in the commercial world. A letter from Mr. G. Collins Levey, the Organizing Commissioner, and one from a Company who have already applied for space, appear in the "Correspondence" columns. It may be that the Exhibition will yet receive a fair amount of support—though not so large as would have been the case had the Institution Committee commenced to put their shoulders to the wheel when they met nearly a fortnight since.

The Safe Depth for Laying Gas-Mains.

It seems that the Alliance and Dublin Consumers' Gas Company are fated to be in litigation, from some cause or another, with officials of the Local Authorities. The quality of gas and the public lighting were at one time the cause of a good deal of strong language; then the steam-roller came along and gave trouble. Three years ago the Rolls Court and the Court of Appeal were both engaged in settling a dispute in regard to the employment of the above-named appliance for the repair of roads, to the injury of the Company's pipes; and the result was that an injunction was obtained. The proceedings, which had reference to an old main, led to the pronouncement by Lord Justice Fitzgibbon of the dictum that in the future the Company must lay their pipes at such a depth and in such a manner as not to be liable to injury from the use of an appliance which is now "a reasonable means of repairing the roads." His Lordship did not venture to suggest what the depth should be; but the Master of the Rolls elicited from Mr. Cowan, the Engineering Inspector of the Local Government Board, that "no pipe would be safe under a road with ordinary traffic at a less depth than 18 inches." Now, the Company lately proposed to lay a main at Stillorgan Park 2 ft. 5 in. below the level of the roadway; but the County Surveyor (Mr. W. Collen) required it to be placed 7 inches deeper. At the same time, the County Council expressed their willingness to sanction a depth of 2 feet only, if the Company would indemnify them against any damage caused by steam-rollers. This the Company declined to do; and they applied to the Magistrate at the Kingstown Police Court (Mr. Drury), under section 9 of the Gas-Works Clauses Act, 1847, to determine the depth at which the main should be laid. A report of the proceedings will be found in another part of the "JOURNAL." It will be noticed that his Worship had before him the opinions of witnesses called on the occasion of the previous litigation, and they ranged from 18 inches to 2 ft. 6 in. He was likewise told by Mr. Hunt and Mr. Herring that 2 feet was a sufficient depth. The Company's Engineer (Mr. Waterfield) stated that Mr. Harty, the Borough Surveyor, was satisfied with only 2 feet; and, curiously enough, Mr. Collen admitted that if he were acting for the Company he would have no hesitation in laying the main at a depth of 2 feet, as it would be quite safe. Why, then, it may be asked, did he not advise unconditional assent to their proposed depth, which was 5 inches greater? It is hard to say. However, his Worship did not take long to make up his mind as to the answer he should give to the question put to him; and he sanctioned the Company's proposed depth, and ordered the Council to pay £10 costs. We fail to see how he could have done otherwise, in face of the evidence of the defendants' own witness; for if 2 feet is a perfectly safe depth for a gas-pipe, one laid 5 inches deeper is not likely to sustain damage by the passing over it of an ordinary steam-roller.

A Discontented Welsbach Shareholder.

A shareholder of the Welsbach Company has been writing to one of the daily papers upbraiding the Directors for all sorts of things for which they are no more responsible than the "man in the moon." He wants dividend, and accuses the Directors of withholding it. He knows that the Company have a large sum of money in hand; and that a dividend has (using his own words) "at last been fairly earned on the new capital. Yet after years of waiting, the shareholder is still doomed to wait, apparently because the Directors do not see fit that things should be otherwise." The writer (who signs himself "Disgusted") must put the saddle on another horse. The people who are responsible for the delay that is taking place are those who have appealed against the confirmation by the Lower Court of the capital reconstruction scheme, which was endorsed by such a large proportion of the proprietors. The Directors have done their utmost to bring things to a definite conclusion for the advantage of all concerned; and the disgust of the complaining shareholder can be nothing compared with their disgust at the conduct of the handful of shareholders who temporarily bar their way.

Gas-Works as a Political Cry.

From time to time when candidates for municipal honours are seeking the suffrages of the electors, statements are made to the effect that the Liberals have managed the local gas undertaking in a much better manner than the Conservatives had done before them, or *vice versâ;* and it always seems to us a great pity that anyone should think it necessary to adduce such arguments in support of his appeal. A good, steady going concern like a gas-works is surely a most unsuitable thing to drag into the arena of party politics; and, besides, why should Liberals (or Conservatives, as the case may be) claim for themselves alone the possession of the necessary business aptitude for the carrying on of such a concern? If there was anything in the argument at all, a very useful addition to "Field's Analysis" and the Board of Trade Returns would be a column showing which was the predominant party in the different councils owning gas-works during the period to which the figures contained therein referred. Again, if it is necessary that a man should be a Liberal (or a Conservative) in order to be able to properly conduct the affairs of a gas manufacturing business, why should not all applicants for the post of manager be asked to state) besides the qualifications which are usually held to fit them for the position) to which party they belonged? Such a question, however, would be rather hard on those who, politically speaking, possessed no settled convictions, for they would be out of it either way. This, of course, is reducing the whole matter to an absurdity; but then in our opinion it is an absurdity to fight municipal elections on party lines at all. A town councillor should be chosen upon his own individual merit, and not upon his "colour." In a speech made to the electors of Leeds last week, by a town councillor on behalf of a municipal candidate, he quoted a great many figures to compare eight years of Liberal management with eight years of Tory management. Profits, price, illuminating power, capital expenditure—everything, indeed, was held to have been better under the rule of the former than of the latter. All his statements may —there is no reason whatever why they should not—be perfectly correct; but that is not the point. Our contention is that other

Tories might do better than those Liberals, and other Liberals might do worse than those Tories; while there is nothing at all to prevent men belonging to no political party from making a better showing than either of them.

More Union Tyranny.

The stand taken by Sir William T. Lewis, with reference to the attempt of the Miners' Federation to coerce non-Unionists in the Marquis of Bute's collieries to join that body, will, it is to be hoped, eventually have the effect of considerably cooling the ardour of the officials; and his action must therefore commend itself to all those who have the real interests of the men at heart. The lengths to which the tyranny of the Federation has gone are well illustrated by a handbill that has recently been published by them in certain districts. A copy of this precious document lately came into the hands of the "Western Mail," and was promptly reproduced in their pages. It is as follows: "Ogmore and Gilfach District of the Miners' Federation. To householders who provide accommodation (lodgings, &c.) to miners and other colliery workmen. It being well known that a number of unprincipled workmen who are willing to appropriate all the benefits obtained through the Federation, are constantly trying to evade their responsibility in supporting the same, we appeal to you to assist us in preventing this imposition by refusing to accommodate (board or lodge) any persons who cannot produce the Federation credentials, or, failing those, a note from one of the Local Lodge Secretaries. Your co-operation in this matter will tend to prevent friction, and also imposition upon the Federation, which has so greatly enhanced the prosperity of the district." It will thus be seen that an attempt is being made to boycott those men who, in the exercise of their undoubted right to do as they please in the matter, elect not to join the Federation. If Sir W. T. Lewis needed any justification in the endeavour he is making to alter the existing state of things, surely this circular would provide it. Not only is a non-Union man to be prevented from working, but apparently now the intention of the Federation is to make it impossible for him even to live. Such a condition of affairs cries aloud for remedy; and if the officials cannot be brought to see the unfairness of the policy they are pursuing, the only thing left to be done will be to check in some way their power for harm. Fortunately, there are men among the employers (and Sir W. T. Lewis is a good example) who will not shrink from the task of bringing the Federation to reason; but the pity of it is that this will in all probability entail heavy loss on masters and workers alike. We agree with our contemporary that the assertion with which the handbill concludes—that the Federation has greatly enhanced the prosperity of the district—is, or may very soon be, open to serious question. Such tactics as are here exposed cannot fail ultimately to recoil on the heads of their originators and of those in whose interests they are supposed to be attempted.

Education and the Chemical Trades.

His Majesty's Consul-General of Hamburg is not disposed to allow that the economic policy followed in Germany during the last decade and the Customs tariff are alone responsible for the remarkable development of the chemical industries there. He has no doubt that the result is partly due to the former cause, and that a judiciously arranged Customs tariff (which, while admitting most chemical primary materials duty free, has protected the weaker branches of industry by more or less high import duties on competing foreign chemical products) has contributed to the development. This admission will perhaps be hailed with considerable satisfaction by our fiscal reformers; but if due weight is given to what follows, it will be found that the Consul-General is inclined to ascribe to other causes at least an equal important place as contributories. Efficiency in the knowledge of chemistry attained after a long and thorough training in one of the many excellent State-aided educational establishments in Germany, unabated study and research after entering practical life, with constant attention to the progress of chemical and physical science all over the world on the part of the technical staff of German chemical factories, combined with a thorough business knowledge on the part of the commercial managers—these certainly have all had an important share in placing the German chemical industry in its present predominant position. The rates of and dividend paid by sixty-one of the prominent German chemical works during each of the last three years are given; and they disclose the fact that only in very few cases has there been any falling off. The average rate of dividend last year for the factories was 8·3 per cent.; while, in the case of twenty-four of them, it exceeded 10 per cent. This shows the flourishing character of the industry. Touching upon this subject, Sir William Ramsay has reminded us lately that little opportunity is given in this country for trained chemists. He says we are producing trained engineers and chemists quite as inventive and capable as our German competitors; but the prospect of a reasonably remunerative career is generally wanting. While in Germany there is a fairly lucrative career for a young chemist, in England—although there will soon be many well-trained men—the openings are few.

WATER AFFAIRS.

Village Water Supplies in Yorkshire.

If any confirmation were needed of the statement made three weeks since in the "Journal," that the sanitary condition of many of the rural districts of this country is extremely unsatisfactory, and that one of the principal causes contributing thereto is the defective water supply, it would be found in a report presented to the Local Government Board by Dr. S. W. Wheaton on water supplies in the rural district of Norton, in the East Riding of Yorkshire. The remark above referred to was made in connection with the revelations contained in Dr. Reece's report to the Board on the sanitary condition of Thorne, situated on the other side of the county; and the two reports, when taken together, present a picture of village life which is simply disgraceful. Before Dr. Wheaton was sent down to investigate the various water supplies in use, the Board had had their attention drawn to their unsatisfactory nature, especially in one village; and the Rural District Council were communicated with thereon. But here, as in the case of Thorne, no steps were taken to effect any permanent improvement, though, as we gather from the report, this might very easily have been done.

Dr. Wheaton gives particulars respecting a number of villages; but Rillington—the largest in the district—may be taken as typical of the others. The houses are situated on both sides of a small stream, and those in the northern portion are supplied from wells constructed of bricks placed loosely together without mortar or cement, and having no external puddling of clay to prevent water entering them from the upper layers of the subsoil. As a well was frequently situated in a foldyard or in close proximity to a pigsty or to leaky middens, defective catchpits, and house drains, we are not surprised that Dr. Wheaton considered the water therein would be "subject to pollution by the "excreta of men as well as of animals." Though the wells were provided with pumps, he found many of them were out of order, so that no water could be obtained; and recourse had then to be had to the stream on which the occupiers of the houses in the southern portion of the village mainly depended. Unfortunately, its condition was little, if any, better than that of the wells. A score of dwellings were dependent entirely upon it, and the liquid refuse from them and from others higher up, in addition to the "droppings from domestic animals, washings from manure "heaps, and filth and refuse of all kinds," all went into the water. Yet the members representing Rillington on the District Council, and also the Parish Council, were opposed to any fresh water supply being introduced. A very similar state of things exists in the other places visited.

There appear to have been no other reasons than indifference and parsimony for the continuance of the unsanitary conditions particularized with so much minuteness by Dr. Wheaton in his report. In the portion of the district lying eastward of Rillington, the water supplies are, as a rule, satisfactory; and the general condition of the villages is good, and in marked contrast to that of many in the western portion. Within a very short distance of the latter there are abundant supplies of water; but they become so polluted before they reach the villages that they are quite unfit for purposes of domestic consumption. As the wells

frequently dry up in the summer, the inhabitants cannot do otherwise than fall back upon the streams. It must be acknowledged that the District Council have endeavoured to improve matters by obtaining control over the sources of water; but they have met with great difficulties, not only from riparian owners, but also on account of conflicting local interests. For instance, the owners of farms within a convenient distance for deriving benefit from a scheme of water supply would naturally favour its introduction; whereas those not so situated would be opposed to it.

Looking at the present state of the law on the subject of water supply, and especially bearing in mind the difficulty of securing the consent of riparian owners, who may regard themselves as being injuriously affected by the abstraction of water from any source for the purpose of public water supply, Dr. Wheaton considers that it would be advisable for the District Council to prepare some extensive scheme for serving all the villages in the western portion of the district from a few of the larger sources of water furnished by the springs, and should then again endeavour to acquire existing water rights by agreement. In the event of failure, the only alternative for the Rural District Council would, he thinks, be to buy land, sink one or more wells in the chalk area, and take underground water. The drawback to this suggestion would be, as he acknowledges, that the water would, in the first instance, have to be raised by pumping, though it could then probably be distributed by gravitation. Considering the needs of the district for water, and the presence of abundant supplies which could be easily and inexpensively distributed, Dr. Wheaton regards it as somewhat surprising that a company has not been formed to provide water for the various villages. No doubt if there were the possibility of a fair return on the outlay incurred in laying down the plant, a scheme and the necessary capital to carry it out would soon be forthcoming. But it seems to us the project would not receive sufficient local support to justify its execution. Some movement in the direction of ameliorating the present condition of things is, however, imperatively called for.

We regret to learn from a telegram sent on Saturday by Mrs. Sadler, wife of Colonel S. A. Sadler, M.P., from Queenstown to Middlesbrough, that her husband had met with an accident on board the *Celtic*, returning from America. Colonel and Mrs. Sadler were with the party of British parliamentary representatives who visited Canada and the United States a few weeks ago. On the 19th, when off Newfoundland, on the return journey, during a high sea, Colonel Sadler slipped on the deck, dislocated his ankle, and broke his right leg. Mrs. Sadler added that her husband was doing well.

At the opening meeting of the Yorkshire College Engineering Society a fortnight since, Mr. E. J. Silcock, M.Inst.C.E., the President, delivered his Inaugural Address, the subject of which was "Municipal Engineering." He said the municipal engineer had probably a greater influence on the health and well-being of the inhabitants of the town he served than any other individual therein. In addition to the control of the conditions of health, he had to direct the policy of the Corporation in employing vast sums of money. Only men who possessed a thorough knowledge of engineering principles, coupled with sound judgment and the capacity to take a broad view of the development of a city, could be trusted to deal with interests of the magnitude which every day confronted the municipal engineer. After referring to the various duties devolving upon the municipal engineer, Mr. Silcock urged that, in spite of the drawbacks arising from association with changing public bodies, the profession to which he had been referring offered good openings to capable men.

Among the appendices to the "Summary of Progress of the Geological Survey for 1902" (which has just been published as a Government paper), are some "Notes on the Occurrence of Natural Gas at Heathfield, Sussex," by Mr. H. B. Woodward, F.R.S. It will have been seen, from the notice of this report which appeared in the "JOURNAL" for the 8th ult. (p. 613), that in Mr. Woodward's opinion the gas which has been obtained must have been stored in comparatively thin layers of sandstone and sand interlaminated with the Wealden clays, and in the harder bands of the Purbeck. It appears to him, therefore, that the gas is derived from the Purbeck shales, and that it may be stored over a considerable area in the thin porous beds. He says that about 300 feet below the region yet tapped there are important beds of sand and sandstone, 50 to 60 feet in thickness, capable of storing a great quantity of gas; and that the absence of water from the strata may be due to the presence of the gas. Importance must attach to this report—expressing, as it does, the independent and unbiassed opinion of an authority so well known as Mr. Woodward.

ESSAYS AND REVIEWS.

GAS DISTRIBUTION AT HIGH PRESSURES.

IT is always to be regretted when there occurs in engineering an appearance of contradiction of theory by practice. This is in truth one of the greatest misfortunes that can befall any branch of engineering, because it tends to the direct encouragement of ignorant "rule-of-thumb," and to the discredit of rational methods of solving the problems of practical working. When one man declares that it is contrary to all science to do a certain thing, and another goes and does it, and glories in his act, there must be something wrong somewhere. One is moved to make these remarks by what has just transpired in connection with the recent San Francisco meeting of the Pacific Coast Gas Association, as reported in the "JOURNAL" on Sept. 1 and Oct. 6. The subject of high-pressure gas distribution was introduced in a paper read by Mr. John A. Britton, which was subsequently discussed. It will perhaps make for clearness if we state that the observations which follow are based upon the verbatim report of the proceedings, which may differ somewhat textually from our abstract reports, though the latter give all the essentials. Mr. Britton is a member of the Board of Directors of the Association, and the Manager of the Oakland (Cal.) Gaslight and Heat Company. He is well qualified to speak on his subject, inasmuch as high-pressure gas transmission has been in operation at Oakland for various purposes since 1885. Readers are referred to our issue for Sept. 1 for the particulars. Suffice it to state here that Mr. Britton's facts of experience adequately support his general thesis, classified as they are by him under the three heads of direct gas supply, "boosting," and the transmission of gas from one storage station to another.

At the present time, the Oakland Company are feeding a holder at a distance of more than seven miles, by means of pressure plant pumping in the gas at an initial pressure of 5 lbs. maximum, and this delivers 50,000 cubic feet of gas per hour into the holder. At an initial pressure of 3 lbs., the delivery is 30,000 cubic feet per hour. There are not sufficient particulars given to enable these data, which we take as correct, to be worked out according to the Unwin formula given in the "JOURNAL" for June 2 last [Vol. LXXXII., p. 586], as the specific gravity of the gas is not known. Still it is possible to make a guess at it, as it is probably all carburetted water gas, and not far short of sp. gr. ·9. The delivery of the main at a high ordinary exhauster pressure—say, 10 inches of water—would be about 11,000 cubic feet per hour. By increasing the initial pressure to 3 lbs. per square inch (about 81 inches of water, or upwards of eight times) the delivery is about trebled. Carrying the pressure to 5 lbs., or about 138 inches, equal to fourteenfold, the quantity delivered is not increased fivefold. These results are, roughly speaking, in substantial agreement with the rule that the delivery of a pipe increases not more than as the square root of the initial pressure. There are corrections to be made for the proportional increase of density of the gas under compression. Taking the facts as given, however, it is possible to review the practice and prospects of high-pressure gas transmission in the light of accepted theory. The experience gathered, so far as can be seen, therefore, does not contradict the theoretical rule that the delivery of gas from a pipe, all other things being equal, varies as the square root of the head or driving pressure. As the gas becomes compressed, the delivering capacity of a pipe increases over this rule. The limitation of velocity being far greater than has ever been attained in practice, there is no physical reason why gas should not be pumped through mains at the highest pressure they will bear. Clearly, such pressures are not at all likely to be reached by pumped gas.

The question consequently descends upon the particular point of relative expense. There are limitations to high-pressure gas distribution; but these are a good way off the ordinary working practice. The first and second applications of high-pressure pumping mentioned by Mr. Britton—the service of a distant holder, and "boosting" in the district—speak for themselves. In ordinary circumstances, a good deal may be done hereby in both ways to improve bad pressures, at a considerable saving of expense over the only alternative—the laying of a larger or an additional main. Mr. Britton, having at his command an 8-inch high-pressure trunk-main working at about 2 lbs. in this particular region, tapped it with a governor working from 10 lbs. on one side to 4 inches on the other, and so made the district pressure right. There is another application of high-pressure gas distribution, which belongs to a different category of operations. This is direct high-pressure supply without a holder. For this, initial pressures of from 1 lb. up to 100 lbs. are spoken of by Mr. Britton; but, as a matter of fact, he has only experience of such a service with a "peak" pressure of 2½ lbs., which falls 3 miles away to 9 inches. This is a cast-iron main, from 5 inches to 6 inches in diameter; and the pumping goes on all day and up to 9 p.m., when the holder pressure of 6 inches becomes sufficient. Contemplating a model installation of this type, the suggestion is offered for compressing plant to 75 lbs. for the peak of the load, with compression tanks on the line to equalize the pressure, and as a

reserve. This, it will be noted, is the first suggestion for the substitution of a gasholder by storage tanks. The plan contemplates constant working, which means duplicating the compressing machinery, and thus considerably adding to the cost. Evidently, unless the thing were done "for the fancy," or for some imperative reason, it is a question here of comparative costs.

Mr. Lowe, who was appealed to on this occasion as an expert in high-pressure gas distribution, gave some interesting information by way of supplementing the paper. He stated that his ideal for serving a small town is a 2-inch main for the trunk, with 1¼-inch branches, and a governor on every service before the meter. Such governors are in the market to work with perfect safety up to 75 lbs. inlet pressure. A single-stage gas-compressor can also be had, working up to the same pressure; and storage cylinders of 3-16th inch sheet metal are purchasable to match. Thus the pioneer plant for supplying a small town on these lines, without a gasholder, can apparently be bought in the United States from manufacturers' stock. Another speaker testified to supplying an outlying district, at a distance of eight miles, in this way without a holder or tanks. The district is encircled by a belt main 2 inches in diameter, with 1-inch branches. The pressure varies from 10 lbs. to 35 lbs.; but tanks are to be put in to equalize it. There is no more leakage than is usual with a low-pressure system; most of the unaccounted-for gas being due to defective consumers' meters. There is little condensation.

It is evident that there must be a considerable saving of time and money with a pioneer plant, in a system of this kind, as compared with a holder system of the ordinary character. At the same time, the expense of running the compressor plant, if capitalized, would go a long way towards paying for a holder, which would be automatic in its action. The question of comparison of systems clearly becomes crucial when the limits of delivering capacity of the high-pressure plant are approached. Obviously, a time must come when the demand will overtax the power even of a compressor running at 75 lbs. pressure; and what is to be done then? The distributing mains act as storage to a certain extent; but when their capacity in this regard is exceeded, a collapse must be very near indeed. It is all very well to rely upon the elastic contents of the mains for storage, so long as there is a good margin between their capacity and the maximum demand, or the peak of the load. This would be the usual condition of a pioneer plant, whether of the high or the low pressure order. But there never was a gas undertaking yet which, if it did any business at all, did not some day outgrow its plant. With gasholder storage, this tightening of the system is gradual, and will go on through a very considerable range without entailing danger of a breakdown. A gasholder at first far too large becomes more and more inadequate; and there are few gas engineers who have not gone through the anxious experience of counting the rivets and praying for putting-out time, as the last sheet sank through the water in the tank. With a high-pressure system of supply, and no holders, any breakdown must be rather of the character of an electric light failure—sudden, irremediable, irreparable for the time being.

Even at the Pacific Coast meeting, a note of uncertainty was sounded in regard to the storage question. Some engineers stated that as business grows it becomes necessary to increase the size of the street mains. This confession very nearly gives the system away, as admitting that the difference between the two systems is merely one of degree. Several speakers hastened to jump into the breach, in order to maintain that the degree is very considerable. They appeared desirous of limiting a high-pressure distribution system to 2-inch mains, with ½-inch services, even in such an example as San Francisco. It was understood that such a distribution would require a great many feeders. As Mr. Lowe explained it: "The feeders would naturally vary in size; but 50 per cent. of all the pipe might be almost the size of a lead pencil, as an extreme illustration—that is of almost no cubical content—and yet having an enormous delivering capacity."

The conclusion to be drawn from all this is that the main comparative question is one of expense. We do not know the cost of compressing gas—the whole gas supply of a town—up to 75 lbs. at the works. Where the consumption is large, it would be an anxious business every day to clap on compressor after compressor as the initial pressure fell in the mains. This system of working may answer well enough for such examples as that spoken of at the meeting, where one expert said he had an 8 in. by 8 in. by 12 in. compressor going, steam driven. This is no very serious matter. If it were a case of millions of cubic feet of gas to be sent out at a moment's notice, the case would be different. Evidently, if the cost of providing and running compressing plant is in direct proportion to its size, while its working efficiency is only in the ratio of the square root of its capacity, the economical limit of working on this principle must soon be reached. This is a point that has not been taken by any partisan of gas supply by high pressure alone. One can hardly doubt that for some purposes, such as those which furnish the experiences retailed at San Francisco, a system of direct gas supply by high pressure has its advantages. But these must be limited, and are certainly relative. It is not to be expected that the practice will grow to applications of any great size, for reasons set forth in the preceding paragraphs. On the other hand, high-pressure trunk mains for the feeding of isolated holders, and for the purpose of "boosting" the district pressures in places where these have fallen below the modern standard, are indicated as useful accessories. It must always be a question for the engineer to determine, however, which is the most economical mechanical appliance available for the purpose. Fans and positive blowers have their recognized limitations of usefulness; but it is probable that machines of this type will usually be found adequate to the calls made upon their assistance for gas distribution, and that compressors will be little used. Not that there is any special danger or engineering difficulty in the mere operation of compressing gas up to any point desired; but it can rarely be truly worth while to do so to a very high pressure, or in any notable quantity.

A SURVEY OF THE BRITISH COAL SUPPLY.

THE first report of the Royal Commission on the British Coal Supply has already been noticed in the "JOURNAL;" and we now wish to draw the attention of those who are interested in the subject to the valuable stock of information contained in the Blue-Book issued with the minutes of evidence so far taken by the Commissioners. The inquiry is not nearly finished; the uncompleted portion of the investigation covering the most important question of the reference—namely, the extent of the available coal resources of the United Kingdom. This is a long and difficult business, involving careful and exhaustive local inquiries, for which purpose the Commission has been split up into a number of District Committees, who are being assisted by mining engineers and experts. The Commissioners are able to report favourably as to the extent of the co-operation they are receiving generally from coalowners and others interested in the coal-mining industry; but this state of things is not universal. Still, on the whole, the inquiry is proceeding satisfactorily; and when the Commissioners complete their labours, the outcome should be a more trustworthy and comprehensive statement of the coal resources of the country than has ever appeared.

The names of some colliery engineers and managers well known to gas managers appear in the list of witnesses, and a fair proportion of the evidence given relates to gas coal. The Commissioners were able to draw up a paper of questions to be addressed to witnesses respecting certain general points which are independent of the extent of the coal fields, yet bear directly on the extent of the available resources—such as the limit of depth in working, the minimum thickness of workable seams of coal, and the amount of waste in working. The present Blue-Book deals almost entirely with these points. In regard to the question of the limit of depth in mining, the Commissioners had the benefit of hearing Mr. Joseph Dickinson, who was a member of the 1866 Commission, which reported during 1871. It was found by this Commission that the limit of workable depth might be taken at 4000 feet. Mr. Dickinson gave some interesting evidence supplemental to the data known to the former Commission. The deepest coal workings he has been in are those of the Pendleton Colliery, and the Moss Colliery, Audenshaw, having made observations in these pits at depths exceeding 3000 feet. The former ranks as the deepest mine in this kingdom at the present time. The seams worked are the Rams seams, varying in thickness from 2 feet to 6 feet. The temperature at a depth of 2955 feet in 1890 was: Dry bulb, 87°; wet bulb, 77°. The heat at the face is a matter of the ventilation, also of the pumping and sprinkling. With large shafts such as are put down now, and modern working appliances, Mr. Dickinson did not think great depth matters very much to the colliers. Speaking of spontaneous combustion, the witness stated that in storing coal liable to this, it is found best to build the heap to the required height and then tip over. Being pressed by the Commissioners, Mr. Dickinson would not say that the former limit of 4000 feet might not be increased to 5000 or even to 6000 feet. On the point of the thickness of seams, Mr. Dickinson has known cannel coal of 8 inches worked. Seams of 24 to 28 inches in thickness are very extensively worked in Lancashire. He regarded 12-inch seams as workable.

Further evidence relating to the Pendlebury Collieries of Messrs. Andrew Knowles and Son was subsequently given by Mr. Henry Bramall. In July, 1902, with the temperature of the air at the surface 64° Fahr., the temperature at the bottom of the workings, 3483 feet below the surface, was 92·5°. The temperature of the rock bottom, taken in a bore-hole in the floor, was 100° Fahr. Mr. Bramall was unable to state any general ratio for the rise of temperature with depth, because it varies so much. The Rams seam, now being worked in the Pendlebury Colliery at a depth of about 3500 feet, is from 5 ft. 1 in. to 5 ft. 5 in. thick. It has both a covering and a bedding of soft stuff which can be scraped out, when the pressure of the rock forces the coal out by itself in large blocks—there being no blasting or picking required. In the Coronation procession, the firm sent a solid block of this coal, weighing 25 cwt., which was got in this way from a depth of 3500 feet. This is a very fine house coal. Mr. Bramall committed himself to two generalizations—that the deeper the mine the drier the atmosphere; and the higher the rate of the colliers' wages the less they will produce. He was reluctant to admit the practicability of getting coal—particularly gas coal, which has to be sold at a comparatively low price—from greater depths than 4000 feet. The difficulty chiefly lies in the temperature and pressure—the former affecting the men's ability

to get the coal, and the latter closing the roads as fast as they are cut. Mr. Bramall was complimented by Lord Allerton, the Chairman, on the lucid way he gave his interesting evidence.

Mr. J. Gerrard, an Inspector of Mines, with experience in the East and West Lancashire and the Yorkshire districts, thought the prospects of coal-cutting machines better with regard to good house coals than for gas or coking coals. The proportion of small is not of so much consequence with the latter. He also stated that thin seams, down to 10 inches, are workable if the coal is of good quality for the house or gas, or really good for the steam classes. The question is a commercial one. Mr. Gerrard was disposed to think that Mr. Bramall had overrated the difficulty of keeping roads open at great depths. He mentioned the cases of the Bradford Colliery, Manchester, which is about to sink a shaft from the surface to 880 yards, from which point they will draw coal. Ashton Moss is another very deep pit. There are now several collieries working at a depth of upwards of 2000 feet, whereas when the former Commission took evidence, there were none. Mr. Gerrard agrees that the deep mines have a dry atmosphere; but the degree of comparative humidity varies a good deal. The air in the deep Bradford mine is not much drier than at the surface. Mr. Gerrard holds that experience has proved the practicability of winning coal from a depth of 4000 feet, but he will not say anything about greater depths until the fact has been established. Conditions vary so greatly that he would not attach much importance to the opinions of even eminent men until coal has been actually worked at 4500 feet vertical depth. There is no insuperable objection to such deep sinking or working. Mr. Henry Hall, Inspector of Mines for the Liverpool and North Wales district, spoke to the subject of depth and temperature. Two of the deepest pits in the district are the Alexandra and the Abram Collieries, Wigan. The former is 775 yards deep at the shaft to the famous Arley seam, 3 ft. 10 in. thick. The air in the mines is very dry; the difference between the dry and wet bulbs being as much as 14° at 91° Fahr., which is considered hot, though the overlookers believe the men could stand 10° more. The coal is not injured by crush, but takes a flaky form. It is cheaper to work than seams at half the depth. Mr. Hall admitted that the depth of colliery workings has increased by 500 or 600 feet during the past 25 years; and he could not say positively why the same process should not go on indefinitely, except for the increase of temperature, which in the Arley seam is in excess of the usual hypothetical rise.

Mr. John Nevin, of Mirfield, spoke to the working of a seam of gas coal, clean and tender, 2 ft. 6 in. thick, the whole of which was got out because it had no dirt in it. Generally speaking, a good gas coal can be profitably worked as thin as 2 feet. Men require to be brought up from boyhood to this kind of work. Mr. J. R. Bennett, speaking for the Somersetshire field, thought there was no evidence for limiting the depth of working to 4000 feet; but he would bar all seams under 12 inches thick. It is interesting, as bearing upon the point of availability, that Mr. Bennett's Company only find five out of about sixty seams in the Bristol coalfield worth working. Another Somersetshire colliery manager, Mr. W. Steart, put the limit of working depth at 5000 feet. A witness from the other end of the country, Mr. R. Martin, of the Niddrie Collieries, Portobello, agreed that there is nothing to fear in a depth of 4000 feet. He is working at 2448 feet already, raising cannel and gas coal. It came out, as common ground with most of the witnesses, that the depth assists the collier to get the coal. Some valuable evidence concerning the cost of very deep mining was given by Mr. H. W. Martin, of Dowlais. He saw no difficulty in raising coal from depths exceeding 4000 feet, but the cost will probably increase in proportion to the depth, largely by reason of the pressure. Important evidence on the subject of coal leases was given by Mr. Thomas Ratcliffe Ellis, the Solicitor and Secretary to the Mining Association of Great Britain. We cannot go into all the points covered by this Blue-Book; but perhaps the nature of its contents has been explained sufficiently to show the importance and interest of the subject-matter.

Sulphate of Ammonia as a Manure.—Readers of the "JOURNAL" will doubtless remember that one of the features of the Brewers' Exhibition held annually at the Agricultural Hall, Islington, is the competition for the prizes offered by the Sulphate of Ammonia Committee, of Fenchurch Avenue, E.C., for the best samples of barley grown with the aid of this valuable residual product of gas manufacture. At the exhibition held last week, the Judges made the following awards: First prize (£25) to Mr. H. Jennings, of Pulborough, Sussex; second prize (£15) to Mr. W. C. Adams, of Dawlish, South Devon; third prize (£10) to Mr. H. A. Cook, of Burnham, Deepdale, Norfolk. The soil on which Mr. Jennings grew his crop was a light sandy one, and it had produced oats and turnips in the two immediately preceding seasons. The quantity of barley grown was 5½ quarters, being at the rate of 10 pecks per acre. Mr. Adams had a soil of red sand with a subsoil of gravel, and the preceding crops were swedes and ley. He obtained 8 quarters of barley, or at the rate of 8 pecks per acre. Mr. Cook worked upon a sandy soil with a subsoil of chalk; and he produced 10 pecks of barley per acre—in all, 4½ quarters. His barley followed a crop of wheat, which had been preceded by one of seeds. He, however, did not confine himself to sulphate of ammonia, but used a combination of this material with superphosphate, bone, and potash.

ELECTRIC LIGHTING MEMORANDA.

The Choice of Prime-Movers—Gas-Engines Coming into Fashion—A Producer Gas-Engine Station at Ryde—Electricity on the Continent.

A VERY remarkable statement concerning the tendency of contemporary mechanical engineering, as regards the choice of prime movers, was made recently by Mr. Mark Robinson, the Chairman of Willans and Robinson, Limited, at an ordinary general meeting of the Company. It must often have struck thoughtful observers of the cause and development of the engineering trades, that there is a good deal of hazard in the way that firms elect to put their money, and such technical skill as they can command, on one particular speciality. This taking of the chances on a proprietary article of manufacture is doubtless one of the highest exercises of the spirit of mercantile enterprise and the faculty of expert judgment; but it would be difficult to rebut the allegation that there is a smack of gambling about it. The example of the Willans and Robinson Company is an illustration in point. This firm elected to take their risk on the high-speed steam-engine, in the manufacture of which they were pioneers. They did this at a time when the most scientific mechanical engineering of the world was devoted to perfecting the slow-speed condensing steam-engine for stationary work, with belt-drive. The Sulzer engine in Europe and the Corliss engine in America were all the fashion in the best engineering circles. But the Willans and Robinson engine directly challenged this election, with conspicuous success. In the capable hands of this firm, the high-speed steam-engine became a characteristic of English practice; and the manufacture of motors of this type was very largely taken up by other English makers.

Scarcely was the supremacy of the high-speed steam-engine established, when a change began to come over the whole trade. On the one hand, the steam-turbine loomed ever larger on the horizon, and the proved success of this type of motor on the grandest scale likely to be realized in the generation of electricity threatened ordinary steam-engine makers with an alteration of fashion in these things which the Willans and Robinson Company have already experienced. On the other side, the possibilities of the large gas-engine bid fair to put even the turbine into a secondary place. Messrs. Willans and Robinson had no turbine, but they "went for" the large gas-engine as soon as they had assured themselves that there was one to suit them; and they are actually doing very well with it. Now, however, they are manufacturing a steam-turbine as well. The importance of the change-over from steam to gas power, in the case of this firm, lies in the prospect of the latter being adopted for some of the big power schemes for which parliamentary sanction has been obtained, and others which will be forthcoming. In view of the condition of the Money Market, most of these ventures will need to be financed by their contractors, if they are to get to work at all. Mr. Robinson hinted that it might be found advisable to take part in this business, in which eventuality it is understood that the advantages of gas as a source of power are likely to be tested on the largest scale. The "Electrician," in commenting upon the condition of things revealed by Mr. Robinson, points out that the first gas-driven electricity works of a large size were British, and that our leading writers on applied thermo-dynamics have consistently pointed out the relative economy of gas-engines. It might have gone on to remark that our leading electrical engineers have, with equal consistency, refused to see in thermo-dynamics any inducement to adopt gas-engines for central station work.

Our electrical contemporary appears to blame somebody for the fact that British mechanical engineering has hitherto left the large gas-engine to be developed by foreigners. The most culpable parties are by implication supposed to be "our manufacturers," who are urged to realize more than they have done the importance of a large experimental construction department, "so that we may develop our new ideas for ourselves." We fancy that some of our leading gas-engine manufacturers, who are not given to endure aspersions on their business capacity and enterprise, would be able to say something on this head. Where is the use of laying out money on the construction of large-engines, if consulting electrical engineers and others refuse to have anything to do with them? The fashion—for it is little better—seems now to be turning more towards the gas-engine, for there is some business being done in large gas-motors for general works purposes; and the "Electrician" this week gives an illustrated description of a producer-gas driven electric lighting plant just opened at Ryde, in the Isle of Wight. This installation strikes one as being just the kind of thing that might be an excellent "side-line" for the Gas Company. The concern is hardly expected, even by the most sanguine, to do very much business, or prove very profitable, because of the purely residential character of the district. The lighting will be only for a very few hours of even a winter's day, and be scarcely worth talking about in summer. Consequently, the cheapest description of generating plant was indicated; and gas power was chosen. The recommendation was partly the small stand-by losses of the producers, which can be left shut up altogether for 36 hours, and brought into use again in a few minutes. The producers and vertical gas-engines of 200-horse power each are

Tangye's. This should be a very instructive station; only, as already remarked, it ought to have been established at the gas-works. Gas companies who possess powers for undertaking this class of branch business would be well advised to take note of this installation.

English readers will not grieve overmuch at the report which comes from Germany that German electrical engineering firms continue to complain of hard times. It is stated in a communication to an electrical contemporary that all reports of a recovery in the German electrical engineering industry are incorrect; and that it is now admitted, in interested circles, that money has been lost for a long time on large machines. This statement has its consolation for those British engineers who have seen the Technical Press filled for years with sensational pictures of huge machines made in German workshops to order. It is further reported that the German cable syndicate has fallen to pieces, so that the firms are now working independently. Some of them appear to be doing better under these conditions. On the other hand, the formation of an incandescent lamp syndicate of German, Austrian and Dutch makers is reported to have had the effect of raising prices. It would probably be preferred by buyers if to this effect were superadded that of improving the quality of incandescent lamps. It is rather good news that the German electrical engineering firms have practically ceased financing their alleged customers for electric lighting and tramway undertakings. Their principal customers now are the iron-works and other manufacturing establishments, which provide a sounder business connection, at a lower price. It is the same in Austria, where the large electrical firms find themselves loaded up with a large amount of unconvertible paper in payment of old contracts. Meanwhile, such genuine work as there is to be done in this line is very much cut. All prices in the trade are down 15 or 20 per cent. compared with the standards of a few years ago.

GAS MANUFACTURING COSTS IN AMERICA.

It may be remembered that early in the present year a National Convention on Municipal Ownership and Public Franchises was held under the auspices of the Reform Club of New York. Among other subjects discussed, was that of municipal gas supply, which found a warm advocate in Mr. Alton D. Adams; and the arguments which he adduced in support of his view were noticed at some length in the "JOURNAL" for May 26 (p. 507). In the September number of "Wilshire's Magazine," which we have just received from America, Mr. Adams again draws attention to the subject by an article on the "Cost of Municipal *versus* Private Gas;" and some indication of the principal facts he adduces will doubtless be of interest to our readers.

Dealing first with private plants, Mr. Adams remarks that the output of a works is not necessarily any criterion of the cost of the gas; and, in spite of the oft-asserted economy of large plants, those having the greatest average outputs do not show the lowest cost of production. Comparing the various States, the lowest net average cost of gas—*i.e.*, the difference between the total cost of manufacture (including all amounts paid for salaries, wages, materials, rent, appliances purchased for sale, interest—not on bonds—advertising, insurance, repairs, taxes, royalties, and other sundry items) and the value of the bye-products—in the last census year, among the private plants, was 48·2 c. per 1000 cubic feet in Missouri, though the average production per plant there was only 104·2 million feet. In New York, the average output of gas per plant was 205·4 million feet, and the net cost 72·8 c. per 1000 cubic feet. Though the amount for material and wages was slightly less in New York than in Missouri, the item of salaries and miscellaneous expenses was 17·5 c. more. Eight States, all of which had a smaller output per plant, showed a lower cost of production per 1000 cubic feet than New York. In Ohio, where the average output per plant was only 47·4 million feet, the net cost of gas was no more than 54·8 c. per 1000 cubic feet; and in Indiana, with an average output of 20 millions, the figure was kept down to 75·5 c. These facts cause Mr. Adams to remark that if there really is much economic advantage in the production of gas on a large scale, it hardly appears in the net cost in New York, Maryland, Rhode Island, Pennsylvania, New Jersey, and Massachusetts, when compared with Wisconsin, Ohio, Delaware, and Indiana, where the average output is much smaller. It is admitted that the average capacity and output of plants in each State, their locations as to the supply of raw materials, and the wages paid to labour, have an important bearing on the cost of gas; but Mr. Adams says these factors are not sufficient to account for the wide variations noted in the net cost.

The article then proceeds to discuss some of the items of which the cost of gas is made up. It appears that, in the matter of materials, Illinois led the way with 21·1 c. per 1000 feet; while the highest charge was in Nevada, where the figure was $1·924. In 23 States the cost was less than 40 c. Care is, however, taken to point out that the difference in the cost of materials in the various States is due in part to the proportions of coal and water gas manufactured. Coming to wages, these were lowest in Maryland, at 9·6 c. per 1000 cubic feet; Nevada being again at the top with 54·9 c. The figure in 33 States amounted to less than 30 c. In this respect, analysis shows that the cost in rather small works is not necessarily high. As regards salaries, Missouri was the lowest with 4·3 c. per 1000 feet, and Nevada once more highest with 91·5 c. This item shows much greater variation than does that of wages; and Mr. Adams says that a number of instances might be given where it differs widely for plants of nearly equal output. In this connection, an interesting point is the relation between salaries and wages in the several States. In Missouri, salaries amounted to only 24 per cent. of wages; while in Illinois and Maryland (with a much larger output), the figures were 59 and 61 per cent. respectively. These proportions, however, are nowhere when compared with those existing in several States. In Mississippi, for instance, labourers received 24·9 c. per 1000 feet of gas made; and 28·7 c. went as salary to officials of the companies. In this matter also Nevada is conspicuous, as for every $1 paid to the labourers, the officials of the companies took $1·66. It may be pointed out that Nevada had the smallest average yearly output of gas per plant of any State.

Coming to the publicly owned works, Mr. Adams remarks that nine States contain municipal plants; and in seven of these the net cost of gas produced by the municipalities was below the cost in the private plants of any State where the average output was not greater. The figure of 52·6 c. per 1000 feet in the municipal plants of Ohio was equalled by the private works in only two States; while the municipalities of West Virginia, with a cost of 44·4 c., make a better showing than the companies of any State. Salaries were much lower; the largest amount per 1000 feet under this heading in municipal plants being 27·3 c., as compared with the 91·5 c. paid by the private plants in one State.

Having thus briefly outlined the points with which Mr. Adams deals fully in his interesting article, it only remains for us to remark that the value of his contribution is greatly enhanced by the inclusion of a table giving the make and the average cost per 1000 cubic feet of the plants in each State, together with an analysis of the various items.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see page 238.)

The week just closed has been a depressed and depressing time on the Stock Exchange. Now and then a slight rally was perceptible; but it soon died away, and the downward course was resumed. The critical state of affairs in the Far East, and the American financial position in the West, have been the two chief factors, aided by other weakening agencies nearer home. Prices all round have suffered more or less considerably; railways being among the chief losers. In the Money Market, there was at times some fluctuation; but a stronger position was later established, and firmness marked the close. Business in the Gas Market has in point of volume of transactions been pretty well on a par with the previous week, though dealings were to a great extent confined to the stocks of the two leading Companies. The tendency was fair at first; and then a downward movement set in, which lasted until the close. This may have had some small element of profit realization in it; but the chief cause was no doubt the general weakness and the scarcity of buyers everywhere. However, only one quotation has suffered to any extent—viz., Gaslight and Coke ordinary, which fell four points. It opened firm on Monday, and once touched 90½. After this it began to give way, and prices steadily shrank, until on Saturday it changed hands once at 85. The tone of the secured issues was also changeful. The maximum gained a point on Wednesday, and lost it again on Friday. South Metropolitan ordinary was following much the same course as Gaslight, but it managed to save the fall in quotation. It opened strong at 120, and then shrank away to a closing mark of 117½. There were a few dealings in Commercials at rather easier figures; but there was no pronounced weakness. Hardly any business was marked in the Suburban and Provincial group. The only change in the London Market was a fall in Alliance and Dublin old, without any business done. Sheffields were strong on the local Exchange, and advanced two more points; while Newcastle debenture was locally a fraction easier. The Continental Companies were almost untouched; only two or three bargains in Imperial being marked. The remoter undertakings were devoid of any feature calling for notice. In the Water Companies, there were more dealings than would be the average of the last few weeks. But it was not a good time for sellers—buyers being very shy and inclined to stand off. Prices were poor whenever they were made, and several quotations underwent reduction—reaching to a 10 per cent. fall in Southwark "D" maximum.

The daily operations were: Gas opened firm and active on Monday, quotations closing unchanged. Tuesday was quieter and weaker, Gaslight ordinary falling 1. Wednesday was steady. Gaslight maximum rose 1; but Alliance fell ½. In Water, New River fell 5, and Chelsea preference 2. Thursday was quiet; and prices were lower. Gaslight ordinary fell 1. In Water, Southwark fell 2½, and ditto maximum 5. Weakness continued on Friday. Gaslight ordinary fell 2, and ditto maximum 1. In Water, Southwark ordinary and maximum fell 5 each, and Grand Junction 2. Saturday's prices were poor; but quotations closed without further change.

FROM EARLY VOLUMES OF THE "JOURNAL."

April 10, 1850.

We announced in a portion of our last month's issue that Messrs. Peto and Betts, the contractors, who had undertaken the erection of the works of the Great Central Gas Consumers' Company, and had at the same time consented to take £50,000 in shares in the Company, foresaw such difficulties in its execution, and entertained such doubts of its ultimate success, as to induce them to throw up their contract, and abandon their shares. It has, however, been since announced that other contractors have taken up the contract; but it is understood that they do not take up the shares, so that the *bonâ-fide* subscriptions amount to only about £85,000, to meet engagements admitted to require £165,000, but which, we believe, will absorb at least £280,000, even had the parties been able to obtain permission to lay their principal mains along the streets and roads connecting their proposed works at Bow with the City of London, without contracting the engagement to light the whole of the intermediate districts on the same ruinous terms. Such, however, has not been the case; and they have elected to pay the penalty of expending another £50,000 in overrunning the suburban parish of Stepney and the scattered district of Whitechapel, without even the shadow of a chance, according to their own repeated admissions, of its ever being remunerative. If ever indomitable perseverance under an accumulation of the most adverse circumstances deserved success, it has most assuredly been merited by the promoters of this Company; but we appeal to all reasonable and unprejudiced men, and ask whether, in the face of the successive withdrawal from the project of nearly every respectable decoy whose name had been put prominently forward to entrap the unwary, the time has not arrived for the few who still remain to take the matter in hand, and fairly consider whether they are justified in continuing such an agitation with the slender chances which £85,000 afford of meeting an expenditure of £330,000.

The Metropolitan public will, we suspect, be more indebted to the London and North-Western Railway Company for any improvements which may take place in the general quality of the gas they consume, than to all the patented inventions of the last ten years. The spirited Directors of the Company have intimated their readiness to carry coal from the Lancashire cannel district to London, at the low rate of one-halfpenny per ton per mile, provided a traffic to the extent of 45,000 tons per annum can be assured. At this rate of carriage, the Wigan cannel, which is exclusively used in Liverpool and Manchester, and which yields a gas superior in the proportion of 22·5 to 12 above the standard adopted by the Great Central Gas Consumers' Company, might be delivered at the Metropolitan gas-works at from 19s. 6d. to 21s. per ton (according to their distance from the railway station, and the means of conveyance), should no augmentation in the present price at the pit take place, in consequence of the London market being thus opened to these collieries.

June 10, 1850.

Most of our readers will already have been informed, through the medium of the daily journals, that, in consequence of the Gas Companies at present lighting the City of London having for a time hesitated to compromise the interests of their shareholders, by yielding to the popular demand for such a reduction in the price of gas as would almost render the capital invested in their works unproductive, the Committee of the House of Commons appointed to investigate the application of the Great Central Gas Consumers' Company has decided that an opportunity should be given to the promoters of the Bill before them of carrying their schemes into operation, by declaring the preamble of the Bill proved, with such modifications as would reduce it to its original proportions—viz., the supply of the City of London alone, to the exclusion of the outlying districts through which its mains must necessarily be laid.

July 10, 1850.

Mr. Defries, well known by his dry gas-meter, has taken out a patent, which promises to excite attention, the object being one in which the public will, no doubt, be disposed to take considerable interest. We were invited on Saturday to witness an experiment at the establishment of this gentleman, in Regent Street, and the advantages of the patent bath, the ground of the invitation, were so fully and completely developed as to leave no room for doubt as to their future countenance. In an ordinary bath, 45 gallons of cold water were thrown. A tray of gas-jets (heating, by a most ingenious apparatus attached to the bottom of the vessel, a large amount of metallic surface, and keeping up a rapid succession of displacements as the fluid becomes gradually hot), raised in the incredibly short period of six minutes the temperature of the water to 106°; the consumption of gas—which, like the time, was accurately measured by a bystander—being barely 28 feet, involving a cost little exceeding one penny. A lesser amount of time and gas would obviously have sufficed to obtain a sufficiency of heat for all practical purposes; hence the extraordinary novelty and economy of the process.

OBITUARY.

By only a comparative few of those who take part in the administrative work of the gas industry was Colonel Josiah Wilkinson known; but to those whose pleasure it was to possess his friendship, or who had been brought into personal contact with him even only occasionally and slightly, the knowledge that he has passed away has, it can be said with confidence, caused a profound sorrow. He was a man among men; and even to the last—venerable though he was, having reached his ninety-second year—there was a robustness and courtliness about his nature that endeared him to all, and made his presence welcome wherever he went. It was as a Director of the Imperial Continental Gas Association and of the British Gaslight Company that he was actively engaged in the gas industry. By him the duties of office were regarded as engagements demanding something more from him than perfunctory performance; and he entered into them with zeal, making himself acquainted not only with the immediate directorial work, but with those who were the officers of the Companies he served, and with the works of which they had charge. And his interest in gas affairs did not stop there. For more than 28 years he served the Imperial Continental Gas Association as a Director, having been elected in February, 1875. Though so advanced in years, his business faculties were keen to the end. He attended with remarkable regularity the weekly meetings of the Board and Finance Committee; and he always brought sound judgment to bear upon the many and varied matters pertaining to a business so ramified and of such magnitude. This was ever cordially recognized by his colleagues when the Colonel came before the proprietors for re-election; and the proprietors, in turn, reposed in him the utmost confidence. His colleagues on the Board and the officers at home and abroad, to-day mourn the loss of a firm friend and assiduous helper. The deceased gentleman was also a Director of the British Gaslight Company, the Board of which he joined in 1880. The appreciation of his work already made in connection with the Imperial Continental Gas Association will, with the conversion of title, apply equally to his connection with this Company. By profession, Colonel Wilkinson was a barrister-at-law; but he seems to have generously devoted himself far more to public than to legal work. He was Honorary Colonel of the 1st Volunteer Battalion of the Middlesex Regiment; and it is believed that he was the oldest volunteer officer in the kingdom. Charitable and other Institutions lose a fast friend and real worker by his death. Of public work, too, he has done a full share. With the exception of lameness and slight deafness—the results of gout—the Colonel enjoyed good health almost to the last, and, as already shown, was able to follow his various occupations close to the end of his long and useful career. He was born in 1812, and died last Tuesday, at his residence at Highgate.

News was received in London on Saturday of the somewhat sudden death on that day, at the age of 65, of Mr. Samson Fox, who will be remembered by our readers chiefly in connection with his efforts to introduce water gas. He had recently been on a tour with his family through Canada and the United States, and on returning to England, in impaired health, some fortnight ago, proceeded to his Walsall residence, where he succumbed to blood poisoning following a surgical operation. Mr. Fox was a self-made man. He was the son of a Yorkshire weaver, and worked at this trade in his early years; but, being of a mechanical turn of mind, he left it when he was only about sixteen, and apprenticed himself to Messrs. Smith, Beacock, and Tannett, of the Round Foundry, Leeds; and he superintended the machinery sheds of the firm at the Exhibition in London in 1862. When still a comparatively young man, he joined his brother and another partner in the business of Fox, Brother, and Refitt, at the Silver Cross Works, Leeds, the business being that of making special tools. In 1874, having previously embarked on the manufacture of iron, he started the business of the Leeds Forge Company for making boiler plates; and this developed into the present great establishment in Leeds. He was a man of many inventions, and took out in all some 150 patents relating to metallurgical and mechanical engineering processes. In most of these he was more successful than in his venture on water gas. Mr. Fox had a palatial residence at Harrogate, of which town he was Mayor three times in succession. During his tenure of the office in 1890, an experiment was made, with the sanction of the Corporation, in lighting the town by means of water gas. It was commenced on the 6th of August, and for a time the lighting was fairly successful—visitors being much pleased with the new illuminant. In September, Mr. Fox invited the members of the British Association to dine on his premises, which were lighted with water gas in the most lavish manner; but complaints were made of disagreeable smell. It was arranged that the experiment should be continued till the 6th of November; but it ended suddenly on the 23rd of the previous month—its originator passing away almost on the thirteenth anniversary of its collapse. Altogether, the abortive trial lasted 76 days. On nine nights the light was very bright; on eight, it was fairly good; on twenty-eight, bad; on twelve, very bad; and in regard to the rest no record was kept. Mr. Fox, as everyone will remember, figured prominently in the movement which resulted in the formation of the British Water Gas Syndicate; but over the incidents connected with that venture it will perhaps be best to draw a veil.

PERSONAL.

We are pleased to learn that at the meeting of the Junior Institution of Engineers on Friday, Mr. SAMUEL CUTLER, jun., was elected Chairman for the ensuing session. As already announced, the new President is Mr. J. Fletcher Moulton, K.C., M.P., whose presidential address will be delivered in January. It may be conveniently mentioned here that what is known as the honorary members' paper is to be given by Professor D. S. Capper, who has selected for his subject "Recent Developments in the Construction and Working of Gas-Engines."

On Monday evening last week, the employees at the Carlisle Gas and Water Works held a smoking concert at the Turf Hotel for the purpose of making a presentation to Mr. HENRY PARK, late head of the stores department, who has accepted an appointment with the Oriental Gas Company. A considerable sum had been subscribed, and this was handed to Mr. Park by Mr. Clarke, who, on behalf of the donors, expressed their regret at losing him, and good wishes for his future welfare and prosperity. Mr. Park suitably acknowledged the gift. Mr. and Mrs. Park left Carlisle the following evening for Liverpool, whence they sailed for Calcutta on Thursday morning.

The Manufacture of Briquettes in France.—In France, semi-coking coals, with from 12 to 20 per cent. of volatile matter, are chiefly employed for the making of briquettes. Very poor coals produce these articles, which burn slowly and with difficulty, and, in burning, rapidly fall to powder. Lignite cannot satisfactorily be employed alone. It should be used in a mixture of, for example, anthracite with 10 per cent. of lignite and 8·5 per cent. of coal tar. Peat is also used with a mixture of anthracite and tar. Various substances have been suggested as binding agents; but the only practicable material is said to be coal tar—"dry" tar being the best form.

American Gaslight Association.—The thirty-first annual meeting of the Association was held last week, at Detroit (Mich.). In a preliminary notice of the meeting which appeared in the "JOURNAL" for the 6th inst., it was mentioned that there would be other papers than the three named. Only one, however, has to be added to our previous list—viz., "Notes on the Operation of Large Carburetted Water-Gas Sets," by Mr. W. Cullen Morris, of New York City. In addition to the papers, arrangements were made for a lecture by Professor Alfred H. White, of the University of Michigan, on "Gas-Engines;" and the Committee on Electrolysis were to present a report containing recommendations as to the measures to be adopted to reduce to a minimum the trouble arising from this cause. We give to-day (p. 219) Mr. A. G. Glasgow's paper on "The Policy of Gas Enrichment, Illustrated by London Practice;" and the other items in the programme of the meeting will be noticed in due course.

Gas Companies' Protection Association: A Correction.—The annual meeting of the Association is to be held at the Westminster Palace Hotel next Friday. The business will be of the usual character; but there will be general regret among the members that Sir George Livesey, being desirous of reducing his engagements, is retiring on this occasion from the Committee. Sir George has occupied the position of Chairman from the inception of the organization. The members of the Committee who are retiring in the ordinary course are Mr. Thornton Andrews, Mr. C. E. Botley, Mr. H. B. Chamberlain, Mr. George Clarry, Mr. J. W. Helps, and Mr. R. O. Paterson. According to the notice convening the meeting, all these, excepting Mr. Paterson, are prepared to continue to serve on the Committee. It is understood that a mistake has been made in excepting Mr. Paterson, who is willing to retire only in the event of the members wishing to infuse a little fresh blood into the administration. This is altogether a different matter; and we hope that Mr. Paterson will long continue to give his counsel in the conduct of the affairs of the Association.

Testing Gas-Engines.—In the Transactions of the American Society of Mechanical Engineers, Mr. E. C. Oliver describes a method of testing gas-engines. For measuring the quantity of air supplied to a 10-horse power Otto engine for the purpose of some trials, he used an engine storage tank of about 90 cubic feet capacity, which was filled with air compressed to 100 lbs. pressure. This air was passed through an expansion or reducing valve to a low-pressure reservoir of about 10 cubic feet capacity, in which a pressure of 1 inch of water was maintained. The pressure and temperatures in the tank were read before and after a test, and the weight calculated from the formula $PV = mRT$, in which P is the pressure in pounds per square foot, V is the volume of the tank in cubic feet, m is the weight of air in pounds, R is a constant for the gas = 53·35, and T is the temperature of the gas in degrees Fahrenheit, measured from absolute zero. The difference in the weights before and after the test represents the amount of air consumed. Two pressure-gauges were connected to the tank—one a high-pressure gauge for the start, the other a low-pressure one for the finish. The temperatures were obtained by five thermometers inserted at various heights on the tank. The readings were averaged, and the true temperature of the air was thus ascertained.

COMMUNICATED ARTICLES.

NOTES ON THE CONSTRUCTION OF INCLINED RETORT SETTINGS.

By ARCHD. S. B. LITTLE.

(*Concluded from p.* 156.)

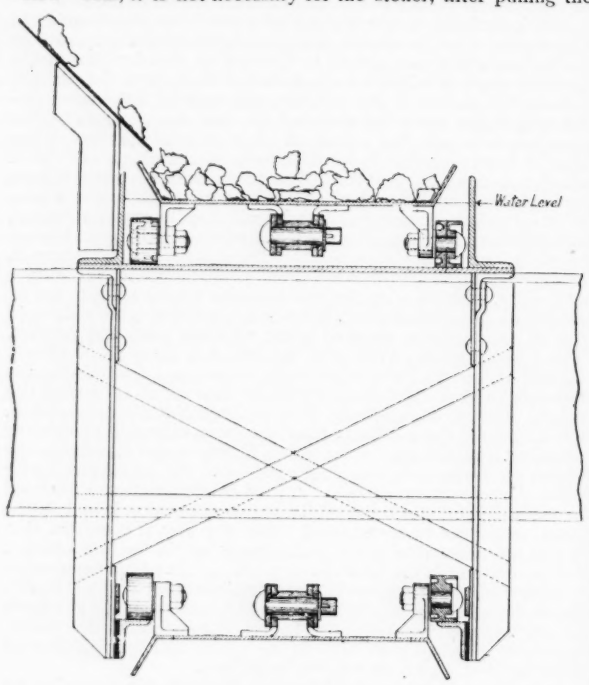
Turning now to the shot-pouch system, the continuous hopper has an outlet over each vertical row of retorts, and closing this is a door, sliding in the top of a chamber which has also a door on the under side. This is so connected with coupling bars and a lever to the top door, that, by pulling a handle from the charging-stage, the top door shuts off the coal in the overhead hopper, and the bottom one is simultaneously opened to discharge the contents of the chamber. To conduct the coal to the retorts, three light travelling shoots are employed, one being for each horizontal row, and a movable foot on each can be put in or out of the retort at will—thus allowing the shoot to be moved as required. By these means, a continuous spout between the hopper and the retort is obtained; and with the control of the lever, the coal required for a charge is precipitated down the retort. The fall is sufficient to ensure the easy running of the charge to the lowest point of the retort, which, as usual, is set at an angle on which the coal would repose but for the impetus gained in the fall.

This practically is the system with which we are familiar in this country; but to enable any gas engineers not fortunate in having the experience gained in working the first installations to properly apply it without a great deal of designing, and perhaps subsequent alteration, the salutory principle of confessing discovered faults must be resorted to, and then, naturally, the remedies to be adopted explained. The angle of the retort being fixed, it is evident that the problem of even-charging is of difficult solution, bearing in mind the different properties of various classes and grades of coal, which will always be met with in gas-works. Washed nuts work wonderfully well with hardly any humouring; but different indeed is the result when small smudge happens to want handling, and equally unsatisfactory the charge obtained from soft, lumpy coal, which, if broken too small, shows too great a percentage of powder, whereas with the crusher rolls set far apart to act as crackers instead of crushers, large lumps get through which could not be conveniently charged along with the peas and powder. The smudge grade, even with the fall, was formerly not lively enough to run to the bottom of the retort, and it banked at the top end, so that only about 2 cwt. got into the retort before the mouth of shoot was choked. The body quickly becoming filled, the balance of the coal from the chamber overflowed between the chamber and the top of the shoot, falling on the man below (or rather on the men, as one could not work the appliances under these adverse circumstances). A prod-headed bar was then used to push the coal down the retort, but what position it took in the retort could not be ascertained. But any way, it is certain that it was not unusual to get a thick charge at the bottom and top, but hardly any in the intervening portion. The time required to complete all these operations was considerable; and, of course, while the mouth of the retort remained unclosed, the gas given off was expelled into the retort-house. The mouth of the charging-shoot, too, had to be kept in the retort, and so got distorted with the heat, and soon required repairing.

With the first appliances, when handling smudge, it was known that the charge would be bad; whereas with the soft lumpy coal, it might sometimes be good or indifferent. As the trouble came in both cases right at the commencement of the working of the plant, all were discouraged. The first point noted was the desirability of getting the coal to go right to the bottom of the retort, whether in grade it was small, nutty, lumpy, or mixed. It was after a time noticed that, as soon as the measuring-chamber was opened, plump went the coal down the shoot; and it could not escape to the retort from the mouth of the shoot as quickly as it entered from the chamber. The slightest jam meant temporary suspension of the coal in the shoot; and thus the benefit of the fall was discounted. To get over this difficulty, two slides were put in the chamber just over the outlet-door, so designed that, when dealing with small coal, they could be fixed in a position to narrow the outlet, and increase the time required to empty the chamber. With a thinner stream thus falling down the shoot, no jamming took place. But, unexpectedly, a supply of nut or washed pea coal might arrive. As might be feared, the narrowing of the discharge orifice made the thin stream too lively; and, before anything could be done, the coal went flying down the retort banking up thick at the bottom. Mr. Herring I think it was, who at Huddersfield brought out a shoot with two wing-plates, placed inside and worked upon swivel-pins, with a view to baffle the falling coal; but as these plates were unalterable during a charge, if the quality of coal altered much, there were no means of checking the fall of the very lively nuts, or allowing full unfettered play to the sluggish slack. The device worked passably in places where, perhaps, only two qualities were used, and these received regularly, with intervals sufficient to give the foreman time to note their appearance, and arrange the baffle-plates to suit. In places where several coal contracts were in operation

simultaneously, it was quite impossible to know exactly what coal to expect in the hoppers. Then in another district where large flinty coal was used, a mixed lot was sent from the crusher to the hoppers—some pieces being large (up to 8 inches long) like Paleolithic implements. With the slides in the chamber or the baffle-plates in the shoot set for small coal, these lumps got fixed in the narrowed orifice; and if this happened towards the end of the charge, perhaps unwittingly the stoker only got about three-quarters of the amount in the retort.

Bearing in mind these failures, it becomes evident that the road to improvement starts with the exit of the coal from the measuring-chamber. No after-checking can be considered satisfactory for the various sorts of coal that every inclined retort plant must be capable of handling. One dodge I hit upon was the making of the bottom plate in the chamber two-and-a-half times as long as the orifice, determining the shape so as to get, in the order following, one full blank, a similar size opening, and half a blank, while the top door was of a similar length, with one part open and one-and-a-half blank. In working this, the usual course was adopted, of pulling over the controlling lever to get a full opening at the bottom and a full blank at the top; and if too much coal was found to fall (showing it to be small), then the operator gave a further haul on the lever, which brought into play the last section of the half blank on the bottom—thus partly closing the bottom outlet, and at the same time the extra half blank at the top travelled over the inlet. This kept out any coal from the storage hopper; so preserving the amount of charge, while allowing for the regulating of the outlet. When handling "slow" coal, it is not necessary for the stoker, after pulling the



Little's New Hot Coke Conveyor.

lever, to approach the shoot, as, with a little practice, he can readily tell if the charge is proceeding well, by the rattle of the coal on the bent part of the shoot. With nut coal, the sound will be of the rattling order; and, if too loud, it is a sign that checking at the bottom is necessary, which, if too heavy a charge at the bottom of the retort is expected, can be done by partly closing a door swinging freely on a pivot attached to the charging-shoot mouth. If the rattle of the coal on the steel of the shoot is not heard all through the charge, there is no doubt the small coal is dropping too quickly, and forming in the shoot; and, if the succeeding coal through falling on coal is not heard, the pulling over of the lever half a stroke checks the outflow. A little practice soon enables the man to distinguish almost any quality of coal by the sound on the shoot.

These hints, if carefully acted upon, will enable users to get equally thick charges of almost any weight; and, without this *desideratum* being attained, endless trouble will result—not the least annoying and difficult to contend with being the removal of the coke. When a professedly automatic plant is put down, one does not expect to have to display his energies in designing mechanical appliances to overcome difficulties arising only through want of appreciation of the principles which must be followed to get the various parts that make up the system do the work for which they are installed. Charging machinery is put in; but if the device does not work without trouble, either the principle or the method of applying or working it is wrong.

Dealing now with the drawing of the coke. When the retort-doors are opened after subjecting the coal to six hours heat, it will be found that, with an uneven charge, in most cases there is a lot of coke in the bottom of the retort, which is fairly free from gas when superficially examined. But let the stoker put in the probing-bar to start the coke in its downward path, and it will be noticed that he simply pokes out a piece which adheres to the mass owing to the viscous properties of the tar that is found to remain in the heart of the mass through want of heat. It will take two or three minutes to dislodge this heavy part of the charge, which is generally about 6 feet long by 1 foot thick, tapering in the length to about 2 inches. Beyond this, the retort is perhaps nearly destitute of coke for a length of 8 or 9 feet; and, in the rest of the retort, a huge lump of semi-distilled coal is discovered. Then follows a wearying five minutes for the poor mortal on the charging-stage. With a thought for what is to come he (perhaps involuntarily) draws a begrimed arm across his exuding forehead and proceeds to mount his three-stepped wheeled bogie, with which a far-seeing contractor has provided him; and from this elevated point of vantage, armed with a murderous looking iron spear, he attacks the stubborn enemy, endeavours to dislodge it, and after hacking it to pieces, with a final charge, sends it hurtling down to his comrades below, who, with a shout of "all out," consign it with sighs of relief to the conveyor. This is not a usual occurrence. Equal difficulties would arise if a horizontal retort was badly charged. With a similar quality coal and an even charge, the view presented in a retort is, of a long, even, incandescent layer of coke about 6 inches thick, which, on being dislodged from the slight accumulation of tarry matter at its lower end, slides bodily out, breaking into huge lumps as it leaves the retort, and these are again divided by falling on to the conveyor.

As the details of the furnaces and charging appliances have advanced, a like appreciation in the machines for moving the materials has resulted, which has brought them to that stage which is just short of the unallowable ideal. If any excuse is necessary for giving one or two examples of these, it is in the fact that American and German visitors to installations in this country state that there is room for improvement in their respective countries. Incidentally, it has been pointed out in this article, that a great deal depends upon the size of the coal; and this makes it necessary to study closely all details connected with the crushing and conveying appliances adopted. The former should always be driven with a belt of such size and strength that it will slip on the pulleys before a wheel or claw breaks—should, as not infrequently happens, a foreign article such as a railway coupling-link or granite set get (or be put) into the crusher. For a like reason, it is necessary to have a door between the top and bottom claws, as such an article may pass the top ones, and pull up the crusher, when, in the absence of some means of easily removing the obstacle, it might be necessary to take out the top rolls, which would necessitate the drawing of keys and gear wheels, pulling apart the crusher frame, and other equally serious removals. It is useless putting an automatic feeder under the crusher, to regulate the supply of coal to the elevator, as all control should be between the supply and the crusher. Circumstances must decide on the most suitable size, shape, and speed of the rolls; but it is always a good plan to drive the bottom rollers at different speeds, as this helps to keep out long pieces of coal which would otherwise sometimes slip through.

Much depends on the elevators, but as these have come into general use during the last ten years, I need not say further than that the capacity should be at least 10 per cent. above what is required, and that the strength of the working parts should be such that, after working for some years, the factor of safety should still be high. Although the temptation may be strong through want of roof space, the elevator should never be bent. A separate or dormer covering should be put up, even if it causes temporary inconvenience, as this is better than the continual worry and noise experienced, and extra power required, with a curved elevator. The conveyor to distribute the coal over the tanks should be quite automatic; and when a scraper pattern is used, the wearing parts should be so made that they can be renewed by the works fitter with materials to be found in every gas-works. I consider it quite waste of money to duplicate any part of the coal-handling plant.

The driving of the coal-handling machinery can be accomplished either with steam, gas, or electric motors; and the intermediate motions should be positive, with the exception of the afore-mentioned crusher driving gear. Or if, as sometimes happens, it is not convenient to use toothed gear right through this section, then the belts should be large, the speed kept high, and only the best quality belts used. In such cases, as a right-angle movement, the bevel wheels should be of steel, and the bearings behind the wheels on the two shafts be bound rigidly together, especially with upright or inclined shafts, as no matter what sort of thrust is adopted, wear will take place, and allow the gears to work out, and, in a very short time, some of the teeth will give way through extra wear and pressure on the points. In some Continental plants, it is not unusual to find the elevator head and a portion of the gearing, carried by piers from the brick-work of the bench; but such a reprehensible practice should not be perpetrated, as the expansion of the brickwork destroys the mechanical accuracy of the gear. My previous writings on the subject of coal-elevating machinery cover all that might be said about such plants in their relation to a retort-house.

Coming to hot-coke conveyors, the best type, in my opinion, is

essentially a carrier. The one with which I am most intimate is made with a single endless chain, having a breaking strain of 19½ tons; the pitch being 12 inches. To this chain are fixed the carrying trays; and in order to keep the grit out of the working parts, the length is 13½ inches, giving 1½-inch lap, the under part being joggled down, so that the trays are practically continuous. They travel in a 24-inch wide iron trough, which consists of a ⅜-inch bottom plate, with two side angles riveted on the square flange, and made water-tight. It has additional bars about 1½ in. by ⅝ in., bolted on to the trough plate and sides, to take the wear of rollers and side wear of the plates. The top strand of the carrier runs on manganese steel rollers, working in brackets fixed on each side of every third plate; the brackets being so formed as to keep the trough clear of breeze, which might get under the trays. The return strand is also carried on these rollers, which, on this part, run on angles supported from the trough by vertical bars.

Engineers will at once notice the simplicity of the design, which has the following improvements over the first patent carrying conveyor: The coke does not slide along in the trough, but is carried away just as it falls from the retort; and there is no friction between the coke and the conveyor—not even on the trays. Owing to the water in the trough, there is no fear of the plates buckling from the heat; and as the coke is quenched by automatic sprays almost as soon as it enters the conveyor, the amount of water is regulated to a nicety, so as not to saturate the coke, or leave it burning in the core, which would be liable to fire the heap. Any surplus water can be drawn from the trays through small holes; and should any dust get through, it is driven along with the water in suspension to the catch-box at the end. Owing to the carrying rollers being fixed on, and moved with, the trays, there is no "knuckle" motion on the chain pins, which must occur when the chains are carried on rollers working on bearings fixed to the framework. All wear then in the conveyor comes on the carrier rollers and pins; and these, being of manganese steel, have a long life, and can be renewed in a few minutes. There is only one chain, which is all steel and bushed—a patent arrangement being made to ensure the 1¼-inch pin being tight in the outside links and the bush in the inside ones; so that there is a long bearing between bush and pin, and no wear in the links whatever.

Every retort-house, whether having inclined or horizontal retorts, should, both from humane and economic principles, be equipped with hot-coke conveyors to take away the coke as it falls from the retorts. As the *morale* of the men improves, it will become daily more difficult to get educated beings to perform the arduous task allotted to retort-house operatives; and when, by a moderate capital expenditure, it is possible to put down plant which will so greatly improve these conditions, and at the same time reap rich reward to the employers, then there can be no excuse for those responsible if the present conditions are allowed to remain unaltered.

In conclusion, may I say that it is owing to the absurd statements made by one or two builders and users of inclined retorts that the improved principle is only now, after a decade of partial inactivity, entering on the progressive stage, which would otherwise have been reached in two or three years under favourable conditions? "But time advances, facts accumulate, doubts arise. Faint glimpses of truth begin to appear, and shine more and more unto the perfect day."

THE GAS ACTS OF 1903.

By Critic.

Reviewing the Acts of Parliament passed last session, one cannot help noticing the sections which provide for the testing of the quality of the gas. The diversity of parliamentary practice in regard to the method of arriving at the value of the gas to be supplied is in no way a settled, finite, or conclusive one, in spite of advanced knowledge. Therefore, it is the object of this article to show wherein the practice is absurd—especially when it does not tend towards uniformity.

It is difficult to understand why one company's gas should be consumed or tested at a fixed rate per hour, while others are to be consumed at such or any rate as shall yield a maximum light for which the burner prescribed was designed—particularly when the same burner applies to both methods.

The same applies to the burners. Some companies are to use Sugg's No. 1 "London" argand; others Sugg's 14-candle or "Wandsworth" argand; and a few may use any burner approved of (or not) by the Board of Trade. An unknown injustice is done to some companies by this variety of burners.

As to the glass chimneys to be employed with the burners, these vary with the conditions so markedly adversely to some of the companies' (and consequently consumers') interests, as will seriously interfere with the prosperity and progress of some of the undertakings. In fact, it is not possible to use one of the chimneys prescribed under the conditions and on the specified burner laid down.

How can (say) A company, using precisely the same coals as B company, compare working results, when the former company's burner (including the prescribed chimney) returns the quality a candle, or even two candles, better than by the method and burner prescribed for B company? It is impossible to do so. Yet the suffering company is expected to sell gas at the same price. Now the selling—not the standard—price is the one that directly affects the consumer's pocket and the growth of such company's business, in spite of a so-called arrangement come to between the parties as to the actual numerical candle value.

In the accompanying table will be found the several companies' testing provisions set out in a way that any one may understand the relative position of each in the matter of arriving at the commercial value of the gas. It will be seen that there are scarcely two methods alike, although all are expected to supply 14-candle gas. The Maidstone Company is the only one that will possibly do this, provided it uses a certain chimney, not prescribed. Looking at the prescription for Derby gas, one finds it impossible to test the gas with the burner and chimney stated in section 54*b* of the Act. What absolute nonsense it is for a Company like the Derby one to go to Parliament to repeal certain sections of its Acts to provide for others which cannot be fulfilled, or even used with advantage to the Company.

Gas Acts for 1903.	Rate of Gas to be Consumed in Burners.	Quality of Gas to be Supplied, 16 or 14 Candles.	Power of Flame to be Maintained.		Size of Chimney Prescribed.			Argand Burner Prescribed.			Make in Millions of Cubic Feet.	Maximum Light that will be Obtained from 14-Candle Gas.	Make per Ton to Maintain 14 Candles. Cubic Feet.
			16 Candle.	14 Candle.	6 in. by 2 in. External.	6 in. by 1¾ in. External.	Diameter. Internal or External.	Sugg's No. 1 "London."	Sugg's 14c. or "Wandsworth."	Any Burner Approved by the Board of Trade.			
Bridgwater	5 feet	14	..	..	Or this	This	External	This	..	..	58	11·0	9,400
East Ardsley	Any	16 to 14	This	..	Or this	This	Not stated	This	..	..	14	13·6	10,600
Wellington	,,	14	..	..	..	..	..	..	..	This	32	..	..
Commercial	,,	14	This	..	..	This	Left to Referees	This	..	..	2660	13·6	10,600
Derby	,,	14	..	This	..	This	Not stated	..	This	..	520	No result. Cannot be used.	..
Faversham	,,	14	Or this	This	†	†	..	..	..	Not stated	51	13·6 (?)	10,600
Hampton Court	,,	14	This	..	†	†	..	This	..	Or this	134	13·6 or 14·0	10,600 to 11,000
Maidstone	,,	14	..	This	†	†	..	..	This	..	255	14·0 (?)	11,000(?)
Walker and Wallsend Union	,,	14	Or this	,,	†	†	..	..	..	Same as at present in use	163	12·0 or 13·6	9,500 to 10,600
Chard Corporation	5 feet	14*	..	..	..	..	..	..	..	..	19	11·0	9,400
Shepshed U. D. Council	Any	14	This	..	6 in. by ?	..	..	This	..	..	6	13·6 (?)	10,600

* Tested in accordance with the Gas-Works Clauses Act, 1871. † No chimney specified in these cases.

The table also gives the approximate make of gas in millions of cubic feet per annum. The maximum amount of light in candles that the new conditions of testing will provide is also given; although a few cases are doubtful, since some one or more essential things are omitted in the provisions of the Acts concerned. Using a fair representation of coal, it is easy to get 11,000 cubic feet of 14-candle gas per ton carbonized; and if this be accepted, then the maximum approximate quantity of gas that each company will be able to make in order to maintain the standard of illuminating power that must be supplied, is shown in the last column.

Accepting these figures as facts, what an amount of money will be lost, and all because the "balance" for determining the value is against a true return, except perhaps in one (a doubtful) case. The consumers will not be a bit the better off for the extra light, and there will not, where otherwise there would, be a reduction in the price—a much more important thing for the contentment of the consumers and the prosperity of gas companies.

THE ARRAIGNMENT OF GAS REFEREEISM.

By C. E. Jones, Assoc.M.Inst.C.E., of Leyton.

Prefatorial.—After an existence of some 35 years, gas refereeism is committed for trial. A Board of Trade search-light is to be focussed on the mysteries of destructive distillation, and coal gas—its manufacture, purification, candle power, purity, and constituents—subjected to scrutiny. The "wake up England" policy of H.R.H. the Prince of Wales appears to have caught on; and inquiry and investigation involve ancient corporations, modern county councils, municipal trading, tuberculosis, physical degeneracy, Polar expeditions, War Office management, trams, docks, Fiscal problems, and even sacred Cobdenite Shibboleths are not exempt from criticism, revision, and change. A spasmodic cry for "efficiency" is heard in the land, and after the grinding of the axe will be as suddenly hushed as it was called for. It is no wonder then that gas has to stand in the ranks of subjects fit for inquiry, and "face the music."

Many changes have taken place in the gas industry since the inauguration of the Board of Gas Referees. As Lord Palmerston would have said: "Many things have happened since then." Legislative enactments have altered—considerably to its disadvantage—the commercial conditions and future prospects of the London Gas Supply; while competition has been keen and not altogether unsuccessful. Cannel (or 22-candle) gas is no longer required, nor supplied; and it is not improbable that 12 candles will represent the illuminating power of London gas in the near future. The demand for coal gas for motive power, domestic heating, and cooking, and an infinity of industrial and other purposes, daily increases in a ratio greater than that required for lighting. A decline in national manufacturing prosperity and the trend of events declare the absolute need of a reliable and economical all-round gaseous fuel such as coal gas offers. Auction clauses and sliding-scales, with their adjunctively "initial prices," cheaper incandescent mantles and high-power lights, the popularity of gas of a lower grade than formerly supplied, and the utter indifference of consumers to the presence of "sulphur compounds" are conditions affecting the well-being of the Metropolitan Gas Companies, and call for readjustment and reformation. Like charity, this should begin at home; and the administration has done wisely in taking sweet counsel and seeking assistance from an industry already the recipient of much grandmotherly legislation, chafing under misfitting harness, and apprehensive lest the load should be increased till the burden becomes intolerable.

By the appointment, therefore, of an Investigation Committee possessing judicial powers over the Metropolitan Gas Companies, the dormant general interest in such technical questions as illuminating power, mode of examination, constitutional purity, freedom from sulphur and ammonia and of compounds thereof, or other impurity by which the gas supplied by them is charged, is awakened and actively revived, and professional expectancy is excited; and the evidence published will be eagerly scanned, and the findings of the Commission anxiously awaited, by all true believers in the needs of the age—viz., commercially cheap gas to displace the use of smoky coal. The polluter of God's atmosphere, destroyer of all architectural and decorative embellishment, and the grimy foundation of London fog—that withering aeriferous compound, the M.D.'s friend, the undertaker's assistant, the housewife's bane, the arrestive hindrance to locomotion, the aider and abettor of thieves, and the most villainous concoction that ever offended nostril or lung. How long, ye citizens of no mean city, will you continue to encourage and to tolerate this huge abomination? Who can measure the direful effects of London fog? Again ye gas engineers to the rescue; hasten the advent of cheap gaseous fuel! Give us an atmosphere free from soot, and the seventh heaven will extol the act. How true it is that "God made the country; man made the town."

Conjectural.—Whether the restrictive regulations now in force will be removed, as urged by the Metropolitan Gas Companies (who, by the way, furnish no less than 25·40 per cent. of the gas sold in the United Kingdom), or so modified as to meet the mutatory exigencies of commercial elasticity, as advocated by others, the supercession of a Board of pure scientists of acknowledged attainments and high character in favour of practical men experienced in trade and commerce, or its total abolition, together with its "prescriptions"—alleged to be compounded of theorematic unattainableness, administered with such strictness of supervision as to harass the overworked officials and their directors, and to render life in a London gas undertaking not worth living, and the result of whose policy hampers and hinders the legitimate expansion of the industry it was created to advise and assist—is the task imposed on the tribunal, and which it is expected to determine. It is devoutly to be wished, but not expected, that the official decision will satisfy all parties concerned.

Statutory Constitution and Otherwise.—The Board of Trade are by statute directed to "appoint three competent and impartial persons (one at least of them having practical knowledge and experience in the manufacture and supply of gas) who shall be called the Gas Referees; and in case of a vacancy happening among them by death, resignation, or otherwise, shall appoint a competent and impartial person to fill the vacancy, one at least of the three being always qualified as aforesaid." Two form a quorum; and at least two must concur in every act and determination of the Referees, who hold office for one year only, but shall be capable of reappointment. Their removal also rests with the Board of Trade. By what power the latter apparently evade or miscontrues the letter and spirit of the statute, is not clear to the lay mind; and it would be interesting to learn which of the "three competent and impartial persons" now constituting the Board has had practical "knowledge and experience in the manufacture and supply of gas," and when and where he acquired the same, since these qualifications constitute a condition precedent to his appointment.

Only one such gentleman qualified as a gas engineer ever held the office; and that was the late Mr. F. J. Evans, who has recorded the fact that he found his colleagues at the commencement of their official career utterly ignorant of their business. He furthermore claimed the honour of instructing them in the most elementary principles of gas manufacture and supply. Since his resignation—which was a sorry episode enough—no successor having practical knowledge and experience in the manufacture and supply of gas has occupied the post. Why has not a gas engineer been appointed? It cannot be for want of suitable and qualified persons. There are numbers of capable gas engineers from whom a selection might be made. The statute does not preclude the appointment of two or even three gas engineers; but the Act says one at least of the three "shall" (not may) always be thus qualified. It was not unreasonably concluded that a professional man would have succeeded Mr. Evans, since the clause of the Act is clear and specific in the imperative mood—"shall appoint," &c.; but for some unexplained reason this was not the view of those possessing the power of appointment. The intentions of the framers of the Act seem, to ordinary minds, to be as clear as a handpike; nevertheless, gas engineers are passed over in favour of men who have never managed a gas undertaking in their lives. Verily, Parliament proposes; but the Board of Trade disposes.

The exercise of patronage by successive Governments is often amusing—not infrequently it is a "muddle," and sometimes mischievous. In this instance, we have an object lesson *tria juncta in uno*. Amusing even to foolishness it is to expect a man to obtain experience, or understand involuted intricacies of gas manufacture and supply, without practical training. Such expectation usually ends in "muddle;" and its final effect has been to wound the *amour propre* of the gas profession, to cast doubt on amateurish competency and qualified impartiality of the triumviral authority, thus unwittingly placed in a false, or at least an equivocal, position. The framers of the Act foresaw such a contingency, and wisely provided "that at least one of the three" should be practically, as well as theoretically, a gas engineer. Here we have the fly in the ointment—non-representation—the stumbling block to administrative "efficiency," a political byeword exceedingly popular at the present time. Indubitably the existing representatives of Refereeism are persons in the well-deserved enjoyment of exalted reputation, sterling honesty, and uprightness of aim, and possessed pre-eminently of ripe scientific culture and erudite accomplishments. But it is not unknown in commerce that such distinguished attainments are supererogatory, and oftentimes, instead of promoting, operate in restraint of trade—a phrase as repugnant to traders now as it was in monopolistic days.

There are living yet men who have not forgotten the long and abortive legal action brought by a late Referee against a London Gas Company, for alleged infringement of patent rights in connection with the purification of gas and the reduction of sulphur compounds by the use of lime. *Paterson v. The Gaslight and Coke Company* seems very ancient history now. It should not be forgotten, however, that the defendants deserve the thanks of the gas industry for the bold front they opposed to one of the most daring attempts to obtain wealth easily, by protecting, by letters patent, knowledge acquired during the exercise of official duties for which the plaintiff had received ample emolument. Since the judgment in the above case was delivered by the highest Court of the realm, few if any Government officials have attempted a similar feat; but nevertheless some had aforetime successfully done so.

Remuneration of the Gas Referees and Others.—Enjoying these patronal rights of appointing and removal, not only of the Referees, but also the Auditor and Chief Gas Examiner (of whom more hereafter), the Board of Trade fix their remuneration, and apportion the same among the Companies according to the paid-up capital respectively; and all expenses properly incurred by them, in or about the execution of their duties, are similarly determined. This money is payable by the Gas Companies "on demand;" and in case of default, the debt, together with costs, is recoverable by the Crown—a process few can withstand with any hope of success. Speaking from memory, the writer believes the salaries of the Referees were fixed originally at £600 to £700 a year, each. The total cost of the department must be great—averaging, it is said, about 1d. per 1000 cubic feet sold.

The Comprehensive Powers of the Referees.—These embrace a variety of objects. Uniquely constituted on the lines of the tribunitian offices of ancient Rome, they are armed with no mean powers of law, equity, and monetary expenditure; and there exists no Court of Appeal except the Board of Trade, Parliament, and Public Opinion. Every "act or determination" of two of them possesses the puissant character of the King's writ, and to what they deem expedient, remonstrance or opposition availeth not.

All official acts are legalized. Without notice, at any and all times, they, individually, collectively, by their clerks, servants, or workmen, can enter the London gas-works and their appurtenances, interrogate officers, examine carbonizing and other books, and investigate the processes of gas manufacture, purification, and supply, with the view of ascertaining the means adopted therein for purifying gas, and for preventing nuisance; may themselves conduct, or direct, such experiments and tests as they may think expedient to be carried out by others, for the purpose of detecting the presence and extent of impurities, by volumetric, qualitative, and quantitative chemical analyses; and the Companies are bound to afford "all facilities for the proper execution of their and his duty," and pay the bill.

They are empowered by law to "prescribe" the number of grains of "impurity" allowable in the purified gas; and to them is committed the task of certifying the mode to be adopted in analyzing and testing the gas, and recording its pressure in the mains, deciding the situation and number of testing-stations within the area of supply, the number of testings per diem, and the seasonal or periodic times thereof, for illuminating power, as well as continuous tests for ascertaining the amount of "sulphur and ammonia, and of compounds thereof, or other impurity." If required by either of the contracting parties, they also are bound to "prescribe and certify" the mode of ascertaining the quantity of gas consumed by the public lamps on the "average meter" or other system of measurement; and their decision is binding on everyone concerned.

Gas Examiners.—Although this discussion was originally intended to be limited to certain aspects and effects of Refereeism as applied to Metropolitan gas affairs, more particularly with reference to the elimination of "sulphur compounds" only, sequentially and complementary it seems desirable to say a word about the staff of "recording angels" employed to observe and tabulate, in the interest of the consumer, the doings of the abandoned gas companies, with the view of securing the statutory illuminating power, purity, and pressure, and punishment for any breach thereof. The excellent photometrical and analytical work, its general accuracy and accordant results, can be ensured only by intelligent painstaking labour; and whatever may be the outcome of the pending inquisition, or this transitional period of gaseous unrest, seeking emancipation from officious control and reduction in candle power—whether it results in substituting the calorimeter for the time-honoured photometer, or, what would be more utilitarian and scientific, a combination of the principles of the two instruments—it cannot be doubted that the staff of examiners will prove their proficiency in any new duties the Referees may think well to impose.

These gentlemen are appointed by the Corporation of the City of London and the London County Council (as successors to the defunct Metropolitan Board of Works) within their respective territorial boundaries, and are not likely to be prejudiced against their employers. Their regulation duties comprise attendance at the testing-place, so as to make daily tests in such manner as the Referees shall prescribe; and the result of each day's work is recorded, and reports sent to the Referees, the Local Authorities, the Companies, and the Chief Gas Examiner. The latter official is appointed, and is also removable, by the Board of Trade, as already mentioned. Quarterly reports are furnished to all parties by the Chief Gas Examiner of the work done and the results obtained by his department; and any company, if aggrieved by the reports of his subordinates, can appeal, within seven days, to the Chief Gas Examiner. If the aggrieved company do or do not appeal, his decision is final and conclusive. Monetary forfeitures are provided for defect of candle power, excess of impurity, insufficiency of pressure, and other *laches*. Such fines are recoverable by magisterial warrant of distress; but no forfeiture is incurred if the Chief Gas Examiner certifies that the cause of such defect was accidental or unavoidable.

As many testing-places as the Referees think necessary must be provided, properly furnished with all apparatus, materials, reagents, and every requisite (including books and incidentals), at the cost of the companies, who exercise no control over, nor are allowed to interfere with, the examiner, though they are graciously permitted the privilege of housing their representative, and providing for their separate use a prescribed testing-place, in the same building. This arrangement is obviously no check on the gas examiner, whose report may lead to legal proceedings. But, on the whole, they do their duty with a minimum of friction and no favour. We sometimes read in the Press of the conviction of such and such a gas company, and fines inflicted for deficiency of illuminating power or excess of sulphur; but these very occasional prosecutions strike one as ridiculous, and are treated by gas purveyors as a good joke—producing an effect the reverse of that intended. Historic examples are, alas, extant of that splenitic pettiness which sometimes obscures the lustre of great minds, deflects the optical axis, darkens inductive mentality, and verifies completely that collective narrowminded bumbledom of local authorities, who could seriously institute, sanction, or approve such puerile proceedings. Of a truth, these magisterial inquiries prove the defendant companies to be most anxious to honestly fulfil their parliamentary obligations, and distribute gas of assured value, of statutory purity, candle power, and pressure. It may be fearlessly affirmed that the immense bulk of London coal gas is supplied to consumers of uniform quality, as directed by Parliament, and supervised by the Board of Gas Referees. To produce London's gas, $3\frac{1}{2}$ millions of tons of native gas coal, and over 6000 tons of foreign oil, are used annually. The business, therefore, is not destitute of importance; and if the conditions under which it is conducted can be, without injustice or danger to the public, rendered less onerous, and its production reduced in cost, coal gas inherits such expansile powers of industrial application as would double its output in a period astonishing to those who predict its early demise.

Advantages of Gas Refereeism.—As in most affairs terrestrial, good and ill are mixed together in varying proportions; and gas affairs exhibit no exception to the rule. Object as they may to the paternal regard of the Referees, the London Gas Companies particularly, and the science of gas manufacture generally, have benefited by their efforts to regulate and improve the Metropolitan gas supply. The creation of the Board of Gas Referees was, under the circumstances of the time, a statesmanlike act, which rendered harmless the harassing agitation of the time. To remove the technical control from polycratic vestrydom to a scientific triumvirate, was, if not heroic, a great advance, for which the Companies had (and still have) reason to be thankful. They were dignified by the change of authority, the direction has been upward and onward, and coal gas boasts of greater purity to-day, and enjoys a higher physical and chemical reputation than it did thirty years ago. If forfeitures and pinpricks have been inflicted, there is comfort in the reflection that it was only an administrative detail, disciplinal, correctional, and good for the flesh. If "Referee" gas proves an ideal incapable of practically useful attainment, we must take what we can get until an alteration is made in the law. None will, however, be disposed to question the honesty of intention on the part of men saturated with chemical, physical, hygienical, and abstract philosophical principles to strive for it.

Pure science is often, to practical beings, painfully academic; and the schools of ancient philosophy, from Pythagoras to Cicero, regarded as Utopian. But we admire the classics, nevertheless; and the world would be the poorer without them. But Gas Refereeism has not been an idealism, nor are its gains inconsiderable. Photometry has been improved, and the measurement of artificial light rendered rather more accurate than heretofore. Sulphur and ammonia, and their compounds, have been reduced to a minimum, and methods of analysis and chemical manipulation, especially with regard to the products of gaseous combustion and quantitative estimation of elusive chemical substances, have been simplified, but not perfected. Practical uniformity in the quality of the gas supplied has been secured, which, from all points of view—of gas distribution, apart from manufacture—is a palpable benefit; and when the enormous volumes dealt with are considered, the few convictions on record for slight variations in luminosity appear unseemly, and serve only to punctuate the fact insisted upon above—*i.e.*, that the gas supplied to the Metropolis is equal to statutory requirements. Nay, the returns of illuminating power furnished by the Chief Gas Examiner show it to be about $\frac{1}{2}$ candle above the standard power, though the Companies get no credit for the extra quality.

Photometry.—The measurement of the intensity of luminous flames, for the want of a perfect standard unit of light, can scarcely be called an exact science; and so long as the human eye—admirable organ as it is—remains the sole arbitrator of relative intensities, it is doubtful if ever it will be, since, with many ingenious proposals appealing for universal favour and adoption, it is not devoid of constitutional imperfections. Evidently less importance is now attached to the illuminating power of gas than formerly; and some experts think the time opportune for the abandonment of judicial photometrical testings in favour of calorimetrical measurements. This, probably, is an extreme proposition incapable of commending itself to all. Nevertheless, advocates for the substitution of the B.T.U. are numerous, if not influential.

Much valuable time and skilful energy worthy of the highest commendation have been expended, with more or less success, in various countries in quest of a universal standard unit of light—positive, constant, perfect, acceptable, and entitled to the confidence of all men. Unfortunately, it has yet to be found. What will be the attitude of the Commission towards the candle power of gas? Who can tell? Meanwhile, low-grade gas is in the ascendant; and efforts are being concentrated towards developing calories rather than measuring luminous intensity. High temperatures are more consequential than oleic or benzolic enrichment; the peculiarities of such mixtures, when certain modes of artificial illumination are employed, are not by any means an unsophisticated blessing. However, it is not the intention of the writer to pursue, in this article, the subject of polemical photometry, pure or applied; his desire being rather to discuss the vexed question of sulphur compounds, with the view of ascertaining if their elimination is worth the cost it involves, or the trouble it entails—to survey the matter from all points of vantage, and endeavour to satisfy the inquiry: Is their retention in the purified gas to the public advantage, or otherwise?

(To be continued.)

The "London Gazette" announces that, under the Weights and Measures Act, a new denomination of standard weight of 50 lbs., or "half-cental," has been made, and been duly verified and deposited.

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

As was predicted would be the case when noticing the arrangements made for the meeting of the Midland Association at Walsall last Thursday, they were of such a nature, and the objects of interest in the Corporation Gas-Works there of such a character, that the members accepted the invitation to be present in a number that, we believe, holds the lead in this respect over any previous meeting of the Association. Certainly with the Mayor, Gas Committee, and other gentlemen identified with the municipal work of Walsall, there must have been at periods during the day as many as 120 to 130 in the large company. The only cause for regret was that rain fell abundantly at intervals; but the plant to be seen at the Pleck Gas-Works was superior in its attractiveness to any damping influence of rain on the sightseers. Indeed, the energetic Gas Engineer (Mr. B. W. Smith) took good care not to allow his visitors one dull moment; and his efforts were heartily supported by the Mayor (Alderman J. Noake), the Chairman of the Gas Committee (Alderman T. P. Brownhill), and their colleagues. The name of one of Alderman Brownhill's brothers occupies an honourable position in the gas industry in connection with the inception of the meter which gave to us the prepayment system of gas supply. Great was the appreciation of the President (Mr. Charles Meiklejohn, of Rugby) and all the members for the generous manner in which the hosts of the day devoted themselves to making the proceedings interesting and enjoyable from the opening to the end of the programme. By the early hour of eleven, the members had assembled at the Walsall Station, where Mr. Smith met, and informally welcomed, them. Brakes then conveyed them to the Hope and Anchor Hotel, where a short business meeting was held.

On the PRESIDENT taking the chair,

The HON. SECRETARY (Mr. A. Cooke) read the minutes of the meeting held at Rugby on May 21; and, on the motion of Mr. B. W. SMITH (Walsall), seconded by Mr. R. O. PATERSON (Cheltenham), they were confirmed.

A CONTRIBUTION TO THE INSTITUTION BENEVOLENT FUND.

The PRESIDENT said before proceeding to the next item on the *agenda*, there was a matter to which he wished to call attention, which was adjourned from a previous meeting—that was, the question of voting a sum of 25 guineas to the Benevolent Fund of the Institution of Gas Engineers. It would be remembered that the matter was brought up at the annual meeting in March last; and it was then decided to postpone it pending the decision of the Joint Councils of the Institution and Institute as to whether the Benevolent Fund would be available to all members of the new Institution, or be confined, as it might have been, only to the subscribers to the original fund. By agreement of the subscribers, it had been determined that the fund should be transferred wholly and solely to the Institution of Gas Engineers; and, consequently, there was no reasonable cause why the Association should not vote the 25 guineas to the fund as originally intended. It had been their experience in the Midlands that they had derived considerable benefit in the case of one of their members from the fund; and the completion of the 25 years' existence of the Association would be appropriately marked by devoting this money to the fund. Then, from causes which would presently appear, he thought there was reason to suppose that the Benevolent Fund would not be in such a flourishing condition as it had been; and all the more reason therefore existed why they individually, as well as an Association, should do what they could to maintain it. He had the greatest possible pleasure in proposing that 25 guineas should be sent as a donation to the Benevolent Fund of the Institution.

Mr. T. BERRIDGE (Leamington) said, as he happened to represent the Association on the Benevolent Fund Committee of the Institution, he could assure the members that it was doing very valuable work. Only in the last month, a further sum of 10s. a week was devoted to the widow of a former member of the Association; and he could assure the members that the fund was thoroughly deserving their support. If any case should come under notice of any gas manager wanting assistance, or of the widow or children of any manager in the neighbourhood, if it was brought to his notice, he would take care it was thoroughly considered by the Committee. He had pleasure in seconding the resolution.

The motion was unanimously agreed to.

NEW MEMBERS.

Proposed by the PRESIDENT, and seconded by Mr. J. FERGUSON BELL (Derby), the following names were added to the roll of the Association: Mr. Joseph Brettle, of Lower Gornal; Mr. Frederick Key, of Lichfield; Mr. Henry R. Skutt, of Kenilworth; Mr. J. H. Brown, of Nottingham; and Mr. Henry Field, of the L.N.W.R. Gas-Works, Wolverton.

ELECTION OF PRESIDENT AND OTHER OFFICERS.

The PRESIDENT said the next item on the *agenda* was the appointment of officers. First of all, he had pleasure in proposing the election of Mr. George Helps, of Nuneaton, as President for the ensuing year. Mr. Helps was well known to every member as an indefatigable worker, and one who had done much to help the proceedings of the Association. He (the President) was quite sure he would worthily fulfil the duties of the office during the coming year. He had the greatest possible pleasure in proposing Mr. Helps's election.

Mr. PATERSON also had much pleasure in seconding the motion. He was certain there was only one feeling among the members; and it was that Mr. Helps was eminently qualified to fill the position. He would have a difficulty in following such an excellent President as Mr. Meiklejohn. But he (Mr. Paterson) thought that Mr. Helps would rise to the occasion, and, in his usual racy, democratic way, would make their meetings pleasant and hearty during the year.

The motion was very cordially agreed to.

Mr. HELPS thanked the members very sincerely for having elected him to the high office of President. He had some doubt as to whether their confidence was not misplaced; but it was no use talking about that yet. Twelve months hence, or rather more, they would have had the fact demonstrated. [No, no.] But he should certainly endeavour to carry out the duties of the office to the satisfaction of the members; and he was perfectly sure he should have their support.

Mr. BELL said the gentleman he had to propose for the position of Vice-President was one whom the members had known for a great number of years; and he had only to mention his name to be sure that it would be received by acclamation. It was Mr. T. Berridge, of Leamington. Mr. Berridge had taken a very active part in the work of the Association; and he (Mr. Bell) looked forward with great interest and pleasure to the time of his presidency. He was certain Mr. Berridge would give satisfaction, and bring credit, to the Association. He formally moved his election.

Mr. G. HELPS, in seconding, observed that it had been his privilege to know Mr. Berridge for some years; and he did not think they could find a man more worthy to occupy the position.

The motion was heartily carried.

Mr. BERRIDGE expressed his obligations to the members for the honour they had done him; and said he should do his best in every possible way to give satisfaction. It was always a pleasure to him to show his works to any brother gas manager; and to give him any information that he possessed. He had always received every courtesy and kindness from his colleagues when he had asked for information; and this, he thought, was characteristic of gas managers. They were not a "close borough;" and they always tried to help one another. They were ever willing to bear one another's burdens; and he was quite willing to bear his share.

The PRESIDENT said the next motion had reference to the Hon. Treasurer; and he should like here to mention that in regard to the vote of a contribution to the Benevolent Fund, the members need have no misgivings as to the state of their funds. It would be remembered that there was at the end of last year about £100 in hand; and when this year's accounts were closed, it would be found —after the 25 guineas were paid—that the Association had still £100 to the good.

Mr. W. A. SAPEY (Tamworth) moved, and Mr. B. W. SMITH seconded, the appointment of Mr. W. R. Cooper (Banbury), as Treasurer; and the proposition was unanimously adopted.

Mr. COOPER, having responded, moved the re-election of Mr. Cooke as Hon. Secretary. He (Mr. Cooper) knew what the secretarial duties of the Association were; and he was confident that in Mr. Cooke's hands they would not suffer.

Mr. G. HELPS seconded the motion, and it was heartily passed.

The HON. SECRETARY having acknowledged this renewal of the confidence of the members,

On the motion of Mr. J. S. REEVES (Bilston), seconded by Mr. BELL, Mr. H. E. Copp, of West Bromwich, and Mr. Fletcher W. Stevenson, of Coventry, were elected members of the Committee, in place of those retiring.

Mr. STEVENSON thanked the members for having elected him a member of the Committee, though a comparatively young member of the Association—having only joined since he came to Coventry. Yet he was an old member of the Association; for some three years before that he was, during the previous eight years, a member. However, he should be very pleased to serve on the Committee, and would do his best for the welfare of the Association.

Mr. COPP said he was pleasantly surprised when he found his name mentioned for office; and no efforts of his would be wanting to fulfil his duties in the best possible manner.

Mr. S. O. Stephenson, of Tipton, and Mr. T. E. Maddocks, of Kettering, were appointed Auditors.

Mr. B. W. SMITH then read the following:—

WALSALL CORPORATION GAS UNDERTAKING.

ITS HISTORY AND DEVELOPMENT.

Walsall is somewhat in a proud and unique position respecting its gas undertaking, as I believe it was one of the first towns which had its own works and one of the earliest gas-works erected. It appears that in 1824, when George IV. was King,

an Act of Parliament was granted for "paving, lighting, watching, cleansing, widening, regulating, and otherwise improving the town of Walsall and the neighbourhood thereof in the county of Stafford." This Act contains some rather extraordinary clauses; and, if I am not digressing, or trespassing too much upon my hearers' patience, I will give a few extracts. In section 22, it says: "It shall be lawful for the said Commissioners to light or cause the several streets, lanes, entries, and other public passages and places within the limits of the Act, or such of them as they shall think proper, to be lighted, either by oil-lamps or by means of gas or inflammable air."

As showing the precautions taken in those days, there is another interesting clause I should like to mention, which states "that all apparatus and pipes, stopcocks, syphons, plugs, and machinery as aforesaid be erected by the advice and direction of some person or persons thoroughly skilled and experienced in the nature of such work," and again, further on, "that twice every year the works should be inspected by one or more experienced person or persons to see that the same are in a fit state and properly conducted and managed, and in case of any error, want of repair, insufficiency or other mismanagement being pointed out, the same to be corrected, amended, or repaired according to the information of such person or persons." So that, in those days, there must have been very few experts to whom that duty could be delegated; but what would consulting engineers of the present day think of such a provision being inserted in new Acts? The gas-works were erected and started by the Walsall Improvement Commissioners in the year 1826, on a piece of land in Lichfield Street, now occupied by the Arboretum.

We have no record as to the exact price at which gas was charged at that time, but the authorized capital was £5000, and the population 12,500. A further Act was obtained in 1848—the capital being increased to £15,000; and new works were built in Wolverhampton Street in 1849 and 1850, after which the old ones were dismantled.

In 1859, the Birmingham and South Staffordshire Gaslight and Coke Company came with their supply to Walsall; and I am led to believe that this was done with a view of finding an outlet for their capital. They continued to supply in competition with the Commissioners in the centre of the town (which was the limits in which the Commissioners could supply) up to 1877; at one time charging as much as 1s. 1d. per 1000 cubic feet extra in the outlying districts, where there was no competition.

In 1875, the Birmingham Corporation bought out the vested rights of the Birmingham and South Staffordshire Gaslight and Coke Company, and Walsall purchased their rights from Birmingham under an Act of 1876, and took up the whole of the gas supply—making an arrangement with Birmingham to pay them a perpetual annuity of £1300 a year in satisfaction of their goodwill and capital outlay, including the present gas offices. This annuity represented a capital outlay of £34,000.

In 1870, Mr. John Tindall was appointed in succession to Mr. Richard Challinor. A few years after they had taken over the Birmingham supply, Walsall found it necessary to enlarge the works; and they had therefore to obtain fresh borrowing powers. As they were unable to extend or secure land near Wolverhampton Street for any additional plant, they purchased land at the Pleck, which site afforded facilities for a railway siding into the works.

In 1876, by a new Act, the capital was increased to £100,000, and subsequently to £357,000. In 1877, part of the Pleck works was constructed, at a capital expenditure of £60,000. In 1892, on account of the continual growth of the business, it was found advisable to extend the Pleck works, in which year No. 2 Section was constructed from plans prepared by Mr. Tindall. In 1895, the old works at Wolverhampton Street were shut down, and the whole of the supply was taken up by the Pleck—the old station being kept for storage only; one of the retort-houses being utilized as an electrical station, and the other for the use of the Surveyor's department.

At the time of Mr. Tindall's appointment, the make of gas was 88 million cubic feet; the population was 48,000; and the profits *nil*. In 1873, the first profit of £622 was made; and this amount continued to improve. In 1899, Mr. Tindall found that, owing to growing responsibilities and failing health, he had to retire. During his term of office, the gas-works had made a net profit of £123,628, of which £115,586 was handed over to the relief of the rates; so that from 1872, including the profits that had been made up to the end of last year, a total of £133,478 net profit was produced, out of which £119,836 has been applied to the relief of rates, while in 1880 and from 1882 to 1884, the profits were sufficient to defray the whole of the borough rate. But in 1881 it was necessary to raise a 6d. rate.

The capital account now stands at £272,797; and the population at about 88,000. The make of gas last year was 484,524,000 cubic feet. The number of consumers at present is about 13,000; (of which 2641 are slot-meter customers, to whom are supplied the usual griller, two brackets, and a pendant), while the number of houses within the borough is 18,767. The number of public lamps is 1337, of which 100 are fitted with incandescent lights. Only 19 lamps in the town are supplied with electricity. The number of cookers is 1004; and there are over 200 gas-engines, which are supplied with gas at a special power rate. The total length of mains is about 69 miles.

As far as I can ascertain, the highest price which Walsall has charged for gas is 5s. per 1000 cubic feet; and this I believe was when it first supplied its own gas. This was undoubtedly a very low figure for that period. The price during the greater part of Mr. Tindall's time was charged on the differential scale—viz., 2s. 1d., 2s. 3d., and 2s. 5d. per 1000 cubic feet. From 1890 to 1892, it was raised to 2s. 4d., 2s. 6d., and 2s. 8d.; and in July of the latter year, the Gas Committee recommended, and the Council adopted, a uniform rate of 2s. 6d., which was raised 3d. on the 1st of April, 1900, on account of the increased cost of coal. Since my appointment, a special reduction has been made in the charge for manufacturing purposes, which is 3d. per 1000 feet lower than that charged for other purposes. Slot-meters are charged at the rate of 25 feet for 1d.; and we find that the average consumption works out to about 8000 to 10,000 cubic feet per annum. This class of business, although little pushed as yet, is growing very rapidly with us.

You are doubtless aware that the Mond Gas Company have recently obtained powers to supply Walsall and other parts of South Staffordshire with gas for other than illuminating purposes, and we have just received notice of their intention to break up the roads in order to lay their mains. I do not apprehend that we shall have much to fear, seeing that the gas-engine power is of such a small size and distributed so much over the town; and if their gas is used with the present engines, it would represent a loss of about 30 per cent. in power. Besides, the Company, after coming six miles with one of their trunk mains to reach our boundary, will have to travel another two miles into Walsall with their pipes before they can secure a single customer. Thus, with electricity for motive power—and there are a few bold enough to use it in the town—and a prospect of a further reduction in the price of our gas, we have every reason to think that the Mond Company will find that they have a very limited field for their operations. The cost of their street works must necessarily be heavy owing to many of the streets being very narrow, and below the surface much congested with sewers, double sets of gas and water pipes, and electric cables.

In conclusion, I would wish to say it has not been my intention to weary the members with a lengthy paper or a statistical account of this undertaking—it being more with an idea of opening the proceedings, as I have provided for the assistance of our friends a guide-book, giving, on the first page, a full description of the manufacturing plant and its capacity, and at the end a map of the works.

The Manufacturing Plant.

In the guide-book to which Mr. Smith refers in the concluding paragraph of his notes, there is much interesting information about the works themselves; and from it the following is prepared. A few special features of the works that—not having then been incorporated in the plant—were not dealt with in the special descriptive, illustrated articles that appeared in the "Journal" in 1902 [Vol. LXXIX., pp. 1344, 1409, 1477], will be enlarged upon in the account of the visit of the members to the works.

On the first page of the pamphlet was the following sketch description of the works:—

Retort-Houses—(No. 1 section.) 14 Beds of eight ⌂ retorts, 22 in. by 16 in. by 20 ft. long, with a block in the centre; regenerative settings; dry main and valves as on Mr. Paterson's principle, but the valves are of a larger size; charged and drawn by West's compressed-air machinery. (No. 2 section.) 20 Beds of eight ⌂ retorts, 20 in. by 15 in. by 20 ft. throughs; regenerative settings; hydraulic main; charged and drawn by hand.

Productive Capacity—(No. 1 section) 1¾ million cubic feet; (No. 2 section) 1½ millions.

Condensers—(No. 1 section.) Two Condensers: (1) Morris and Cutler's water-tube; capacity, 1½ millions. (2) Annular vertical; capacity, 750,000 cubic feet. (No. 2 section.) One Condenser: Vertical water, Clapham's patent; capacity, 1 million cubic feet.

Exhausters—(No. 1 section.) Two: (1) 100,000 cubic feet per hour, by Donkin; (2) 50,000 cubic feet per hour, by Waller. (No. 2 section.) Two: (1) 100,000 cubic feet per hour, by Donkin; (2) 50,000 cubic feet per hour, by Donkin.

Washers—(No. 1 section.) One Livesey washer; capacity, 2 millions. (No. 2 section.) One Livesey washer; capacity, 2 millions.

Naphthalene Scrubber—(No. 1 section.) Holmes' patent rotary type; capacity, 2 millions. (No. 2 section.) Part of the Clapham washer is used for naphthalene.

Scrubber-Washers—(No. 1 section.) 1—Holmes' patent rotary type; capacity, 1½ millions. This has been altered so that the first four bays are for cyanide recovery, and the last four bays for ammonia. 2—Holmes' patent rotary type; capacity, 750,000 cubic feet. The first five bays are for cyanide recovery, and the last six bays for ammonia. (No. 2 section.) 1—Holmes' patent rotary type; capacity, 1 million. Six bays for cyanide recovery, and the last four bays for ammonia. 2—Clapham patent rotary type for naphthalene and ammonia; capacity, 1 million.

Purifiers—(No 1. section.) Four oxide boxes and four lime boxes. These are on Green's patent system, and are in pairs, 48 ft. by 36 ft. by 6 ft. deep. They have two discharge ports in the bottom of the box, and two conveyors underneath the whole length of the purifiers to take the spent oxide away to the revivifying-floor by means of an elevator and overhead conveyor. There is an elevator and conveyor for returning the material to the boxes. (No. 2 section.) Two lime boxes and four oxide, 20 ft. square

by 5 ft. deep; water lutes; charged and emptied by hand and barrow.

Meters—(No. 1 section.) Two meters, both 50,000 cubic feet per hour capacity, by Braddock. (No. 2 section.) One meter, capacity, 100,000 cubic feet per hour, by Parkinson and Cowan.

Carburettor—By the Gas Lighting Improvement Company; 90 per cent. benzol used.

Gasholders—

Pleck Works—

		Capacity. Cubic Feet.
No. 1	Two lifts, 120 ft. dia. by 52 ft. high . .	529,000
,, 2	,, ,, 123 ft. ,, ,, . .	557,000
,, 3	,, ,, 123 ft. ,, ,, . .	557,000
,, 4	Three lifts, 150 ft. dia. by 90 ft. high. .	1,478,000

Wolverhampton Street Works—

No. 1	Dismantled.	
,, 2	Two lifts, 70 ft. dia. by 32 ft. high . . .	117,000
,, 3	,, ,, 94 ft. dia. by 40 ft. ,, . . .	280,000
	Total Gasholder Capacity	3,518,000

The Wolverhampton Street works is now only a storage station, and is fed from the Pleck by the difference in gasholder pressure during the summer, and in the winter by an exhauster driven by a gas-engine.

Governors—Pleck works: One 24-inch, by Cowan; two 20-inch, by Braddock. Wolverhampton Street works: One 12-inch, by Cowan; one 12-inch, by Braddock; one 12-inch, by Parkinson.

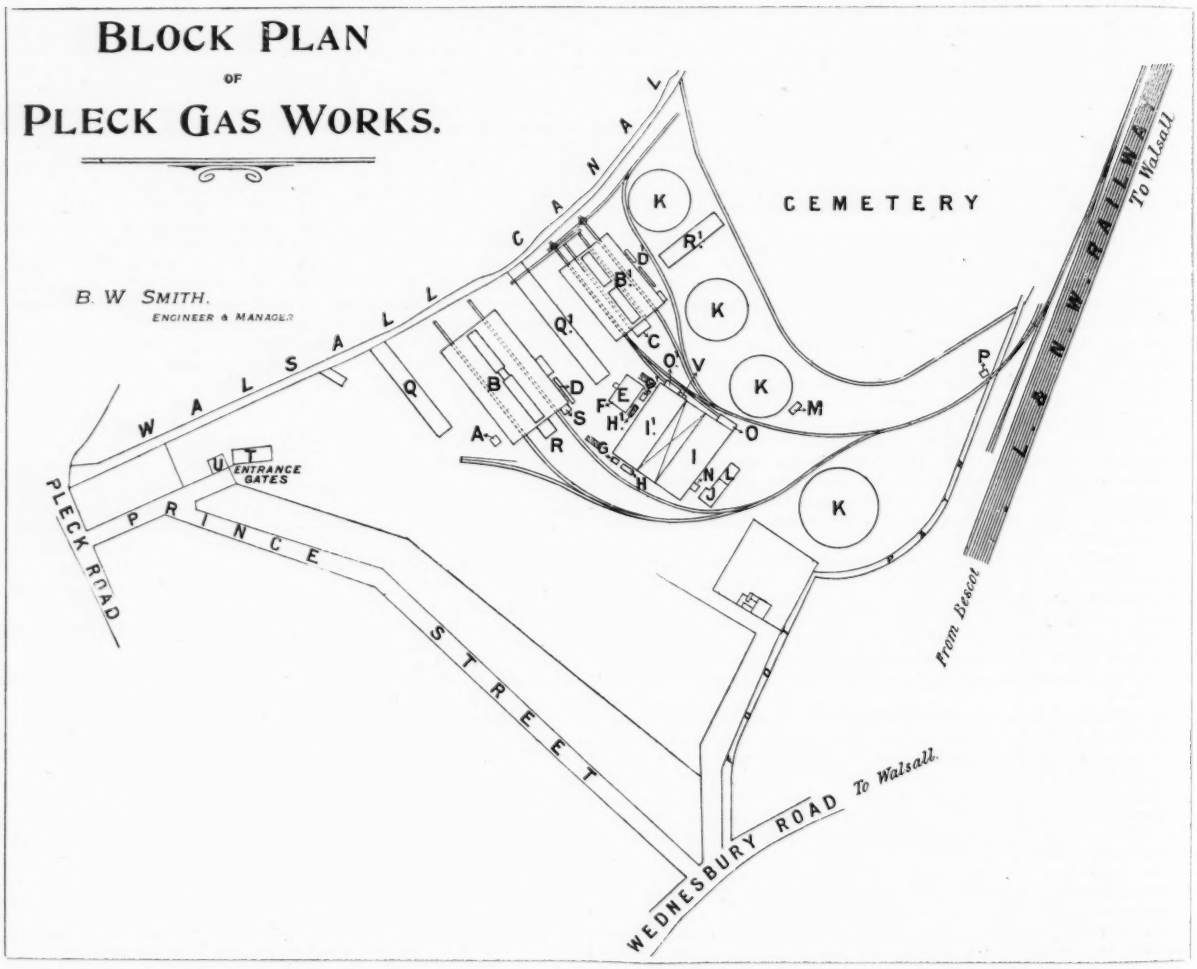
Boilers—Two 100-horse power, fired with breeze dust and Meldrum's forced draught.

There are eight gas-engines on the Pleck works, varying from 43 brake horse power to 6 brake horse power, for driving the coal-breakers, coke-handling plant, unloading and loading purifiers, and machinery in workshops, &c.

Area of Works—Pleck works, 22½ acres; Wolverhampton Street works, 2½ acres—total, 25 acres.

The foregoing sketch description of the works is supplemented by Mr. Smith with explanations, from which we have extracted the following. The black letters correspond with those on the plan, and will show the disposition of the plant.

Breeze Plant (**A**).—This machine was recently designed and erected for dealing with the refuse after the coke is removed. It screens the material; separating it into four different sizes. The first is suitable for domestic purposes, which, on being mixed with coal, makes a beautiful fire; the second size is used by blacksmiths or for heavy



work; the third is for forge or light work; and the fourth is breeze dust, which is sold and used for boiler purposes under forced draught.

Retort-House, No. 2 (**B**).—This house is not worked by machinery; the drawing and charging being done by hand and the coke removed in wheel-barrows. There has, however, just been fixed a De Brouwer electrically-driven charging-machine, made by Messrs. W. J. Jenkins and Co., of Retford, who have kindly lent the apparatus for the inspection of the Midland Association. It can be employed with any size or shaped retort, either without, or in conjunction with, electrically-worked drawing machines and a coke-handling plant.

Retort-House, No. 1 (**B**^{1}).—This house was recently remodelled. The coal is brought in direct by truck, unloaded into the hoppers, broken by a crusher to a suitable size, elevated, conveyed, and stored by machinery; and by gravitation is fed into the charging-machines. Both the drawing and charging machines are worked by compressed air. The coke is carried along by the conveyor, which is worked by a gas-engine, and is quenched as it travels along, screened and loaded direct into boats or stacked as the case may be. The gas-engine is fixed in a building inside the retort-house.

Compressor-House (**C**).—The air for driving the machinery is compressed by a steam-engine. Two gas-engines are also installed here for driving the machinery for breaking, elevating, and conveying the coal to the overhead hoppers. This house was formerly the blacksmiths' shop. At the side of the retort-house is the shed for the boiler in which the compressed air is stored.

Condensers (**D**, **D**^{1}).—From the retorts the gas passes along the pipes, round the retort-house, and through the condensers.

Exhauster-House (**E**).—In this house there are two sets, in duplicate, of steam engines and exhausters; one set each for Nos. 1 and 2 sections.

Boiler-House (**F**).—Two boilers are installed, each of 100-horse power; the fuel used being breeze dust under forced draught.

Livesey Washers (**G**, **G**^{1}) *and Rotary Washers* (**H**, **H**^{1}).—After leaving the Livesey washer, the gas passes through the oil washer for the extraction of naphthalene. This apparatus has been specially made, and is of the same construction as the ammonia washer. The first two bays contain benzolized creosote; and the last one strong ammoniacal liquor. One of the rotary washers has been recently altered, and two others built for the extraction of cyanide, as well as the ammonia. They are worked under the patent process of the British Cyanide Company, of Oldbury. Each washer is divided into halves, with a still chamber in the middle—the first portion for the cyanide, and the other for ammonia extraction. Clean water is used in both cases. In the bays for the extraction of cyanide, strong liquor is maintained by the absorption of part of the free ammonia, granular sulphur being added, as required, through the hoppers, forming polysulphides of ammonium, which combine with the hydrocyanic acid in the gas—thus forming sulphocyanide of ammonium; the remainder of the ammonia in the gas being taken up by the end bays. The overflows are fixed on each side of the still-chamber, which is divided by a plate into two compartments.

Purifier-Houses (**I**, **I**[1]).—The plant has been re-modelled. The purifying material is unloaded at the bottom of the boxes and carried away by machinery, and distributed on to the revivifying-floor to revivify. When the boxes are charged, the material is brought back again by machinery and falls direct into the box, and then shovelled up to the proper depth. The gas-engine for driving the machinery for unloading the boxes is in the vault beneath; and at the end of the purifying-house, marked **V**, is the gas-engine for driving the return plant for charging the boxes. It may here be mentioned that the whole of the purifying plant is electrically lighted, to minimize the risk of fire or explosion. **I**[1] is typical of what the building **I** was before the alterations were made. The first series of purifiers contain oxide, and the second series are charged with slaked lime.

J are the *Station Meters;* **K**, the *Gasholders;* **L**, the *Governors*, one of which has been recently added. **M** is a small house (recently erected) containing an exhauster, driven by a gas-engine, to force the gas from the works to the holders in Wolverhampton Street, which is now used only as a storage station.

Enriching-House (**N**).—This has been erected with the double view of increasing the illuminating power of the gas, and as a solvent for naphthalene salts.

Locomotive-Sheds (**O**, **O**[1]).—The engines are used for bringing in and taking out the coal-trucks to the railway sidings. **P** is the *Weighing-Machine House*: and **Q**, the *Canal-Basins*.

Men's Rooms and Workshops (**R**).—This is a recently-erected building. The first portion contains a mess-room, bath, and lavatory for the stokers who work in No. 1 retort-house. Adjoining is an iron-stores in connection with blacksmiths' shop, where there are two hearths worked by a fan. Next to this is the fitters' shop containing a gas-engine for driving the fan, a lathe, drilling-machine, shearing and punching machine, and also a saw-bench in the carpenters' shop at the end of the building. All repairs to machinery, &c., can be executed on the works.

Pumping House and Tank (**S**).—The pumps are for pumping water for quenching coke or other purposes. The overhead tank is for tar and liquor, which is loaded into boats by gravitation.

Offices and Shopping (**T**).—In connection with these are the stores, where materials are stored and booked in and out for the works and the district.

[Before the section of the foregoing notes referring to the history and development of the Walsall gas undertaking was read, it was explained that it was merely for the information of the members, and not for discussion.]

A Vote of Condolence.

The President said, before they left the meeting, he should like to perform what was a painful duty, and that was to propose that a vote of condolence be sent to Mrs. Roberts, the daughter of the late Mr. Charles Taylor, who was a Past-President of the Association. He should like to couple with the resolution a vote of sympathy with Mr. S. Meunier on the loss of his wife.

Mr. Berridge, in seconding the motion, said that most of those present knew what it was to lose very old and near and dear friends; and they could deeply sympathize with Mr. Meunier, and with Mrs. Roberts on the loss of her father.

Light refreshments were then served; and after these had been discussed, the members walked to

The Pleck Gas-Works.

At the main entrance to the works, the visitors were received by the Mayor and the Chairman and members of the Gas Committee; and, in a few genial words, his Worship bid them, on behalf of the Corporation and town, a hearty welcome. He said that he had no doubt some of the members had come from larger places than Walsall; but, before the inspection of their works ended, he thought it would be agreed that they did try in Walsall to keep themselves and the plant up to date. For the members, the President acknowledged the cordial greeting, and expressed how much they were all anticipating the inspection. The reputation of the works, of the Corporation Gas Engineer, and of the previous Engineer (who was one of the earliest Presidents of the Association) was, he said, known to every member.

The large party was then split up into three—the first being conducted by Mr. Smith, the second by his Assistant (Mr. S. T. Smith), and the third by his pupil (Mr. G. E. Shepherd), to all of whom the members were much indebted for their courtesy and for the freedom with which they imparted information voluntarily and in reply to the thousand-and-one questions with which they were plied.

The notes already given from the abundant material supplied by Mr. Smith, in conjunction with the illustrated articles published in the "Journal" last year do not leave many subjects claiming special treatment. Following the course taken by Mr. Smith's party, the breeze-screen was first examined; and then No. 2 retort-house was entered. It was at once observed that there were only two beds under fire, out of the twenty in the house; and this afforded an excellent lesson in retort-house economics. The small demand on the house is one effect of the conversion of No. 1 house to new conditions of working. Besides working at a lower cost per ton of coal carbonized, from the area covered by the benches in No. 1—the same area as under the conditions that existed in the winter of 1901-2—nearly enough gas is produced to meet the requirements at this time of year. It was not always so. Speaking of costs, it may be of interest to give some figures bearing on the working of No. 1 house; but before the total figure is taken by anyone for comparison, the several items comprising the total may be recommended to consideration. The figures are for a week—from Dec. 4 to Dec. 11, 1902.

Cost of Carbonizing in No. 1 Retort-House, Dec. 4 to Dec. 11, 1902.

		£ s. d.
Machine men	4 × 3 shifts × 6 days at 5s. 6d.	£19 16 0
Lid men	4 × 3 ,, × 6 ,, at 5s. 6d.	19 16 0
Firemen	2 × 3 ,, × 6 ,, at 5s. 6d.	9 18 0
Top foremen	3 × 3 ,, × 6 ,, at 5s.	13 10 0
Coal trimmers	2 × 3 ,, × 6 ,, at 4s. 9d.	8 11 0
Engine driver	1 × 3 ,, × 6 ,, at 5s.	4 10 0
Sunday work (two-thirds) time-and-a-half		12 13 6
Gas used by engines, 40,000 cubic feet, at 2s.		4 0 0
16 gallons of engine oil at 10d. per gallon		13 4
6 ,, gas-engine oil at 1s. 2d. per gallon		7 0
2 ,, cylinder oil at 1s. 3d. per gallon		2 6
4 ,, lever oil at 11d. per gallon		3 8
2 ,, chain oil at 7d. per gallon		1 2
12 lbs. of cotton waste (best) at 15s. 6d. per cwt.		1 6
24 ,, ,, ,, (common) at 13s. 3d. per cwt.		2 10
		£94 6 6

Coal carbonized, 1097 tons.

	Per Ton Carbonized.
£94 6s. 6d. ÷ 1097 tons =	21·750d.
Repairs to stoking machinery—average of 20 months' working	0·696
	22·446d.
Cost of working coke-conveyor (including repairs)	3·878
Total cost of retort-house working machinery, screening and loading up coke into boat or carts	26·324d.

Comparing with 29·68d. in No. 2 house without machinery, and a smaller productive capacity per bed with the old plant, with the cost of 6·55d. per ton of coal carbonized for handling coke, making a total of 36·23d., against 26·32d., or a net saving of 9·91d. per ton of coal carbonized.

The figure referring to the repairs of the stoking machinery represent the average on twenty months' working, during which period 61,343 tons of coal were carbonized. In the same time, £399 5s. was spent on the upkeep of the coke-conveying plant; and, dividing this sum by the 61,343 tons of coal carbonized, the average of 1·56d. per ton is arrived at for repairs. Some interest is sure to be evinced as to how Mr. Smith makes up the working cost of 3·878d. for the coke conveyor per ton of coal carbonized. This table will tell the tale—

Cost of Working the Coke-Conveyor, Jan. 1 to Dec. 31, 1902.

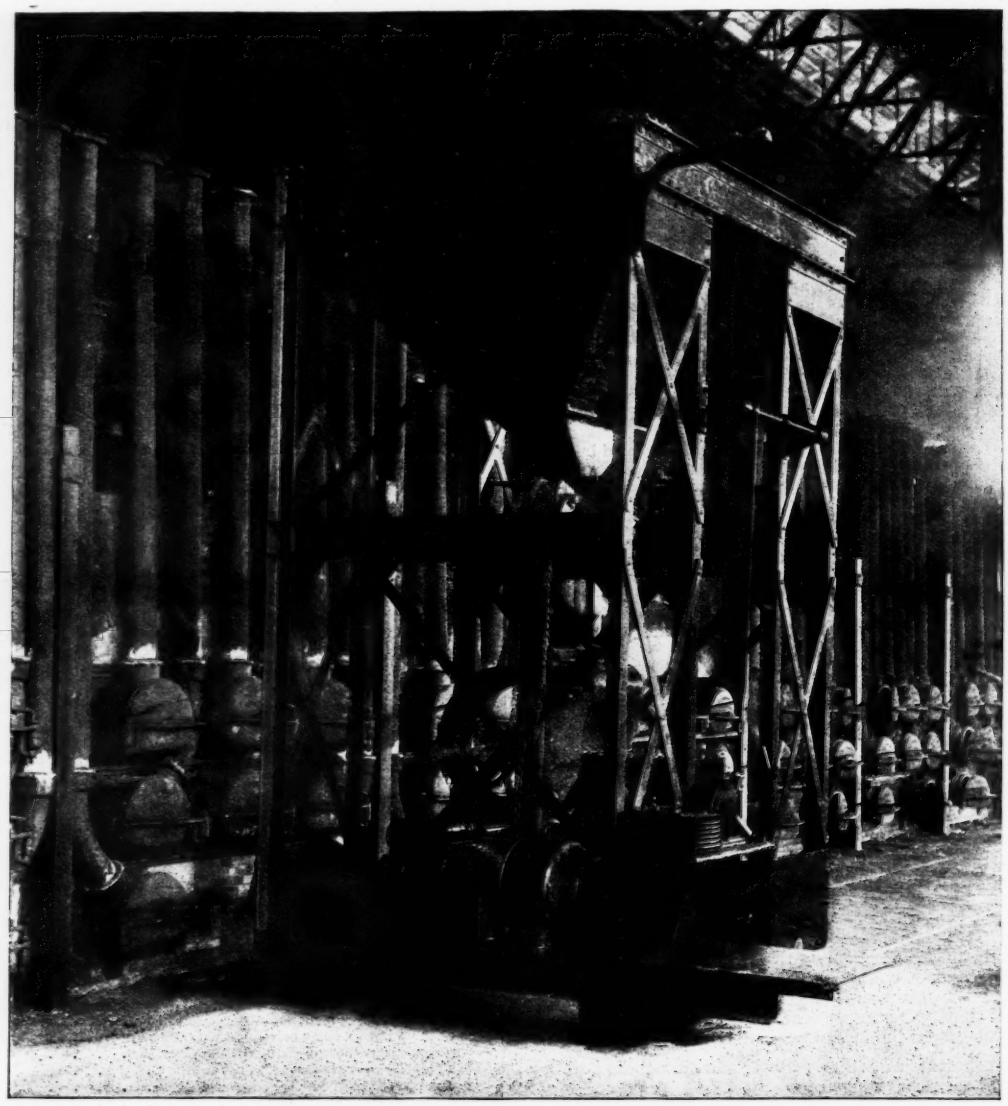
	£ s. d.
Three engine drivers at 5s. each per day, and one-and-a-half time on Sunday = £4 4s. per week, £4 4s. × 52 =	£218 8 0
Gas used by engines, 1,146,300 cubic feet, at 2s.	114 12 6
53½ gallons of engine oil at 10d. per gallon	2 4 7
62 ,, gas-engine oil at 1s. 2d. per gallon	3 12 4
129 ,, chain oil at 7d. per gallon	3 15 3
2 cwt. 3 qrs. 7 lbs. of waste at 14s. 4d. per cwt.	2 0 4
2 qrs. 23 lbs. of soda at 4s. per cwt.	2 11
1 qr. 15 lbs. of soft soap at 12s. 6d. per cwt.	4 10
3 qrs. 24 lbs. Stauffers at 29s. per cwt.	1 8 0
12 sheets of emery cloth at 7d. per doz.	7
130 sponge cloths at 1s. 1d. per dozen	11 9
6 lbs. of resin at 1d. per lb.	6
19 lbs. of tallow at 35s. per cwt.	5 9
	£347 6 4

35,955 tons of coal carbonized in No. 1 house. £347 6s. 4d. ÷ 35,955 tons = per ton of coal carbonized.	2·318d.
Repairs	1·56
Actual working cost	3·878d.

A De Brouwer Coal-Projector.

But the feature of predominant interest in No. 2 house of which this little excursion into working costs has delayed notice, was a De Brouwer coal-projector, which had been hurriedly installed for the information of those members who had not previously had an opportunity of seeing it in operation. We give a photograph of this particular machine, and cannot do better than to at once briefly describe it. This is the type of the machine that is self-contained—carrying its own coal-hopper, and travelling on rails laid in the floor of the retort-house. All the work external to the projector proper gives the machine a much more imposing appearance than when the projector is simply suspended on rails, and is fed from overhead measuring-chambers, as in the case of the inclined retort system. With the latter method of operation, the feeding of horizontal retorts is brought as near to the system of feeding inclined retorts as perhaps it will ever reach.

However, this particular machine as seen at Walsall consists of two parts—viz., the projector and the carriage and storage hopper for carrying a supply of coal to feed the projector. The projector is of the ordinary type, and is, in fact, the machine which the makers (Messrs. W. J. Jenkins and Co.) have been showing for some months at their works at Retford. It is driven by electricity, which is conducted to the motor from the mains by flexible insulated cable. The charging apparatus is carried between turned guides, and can be hoisted or lowered to the various tiers of retorts by the totally enclosed reversing motor, which is used to propel the frame and hopper on the rails laid in front of the retort-bench. The frame consists of a strongly braced structure made of channel and angle steel, and is carried on axle wheels 2 feet diameter; the axles running in



THE DE BROUWER PROJECTOR (EXHIBITED AT WALSALL), WITH FLOOR CARRIAGE AND FRAME, SUPPORTING 5-TON COAL-HOPPER.

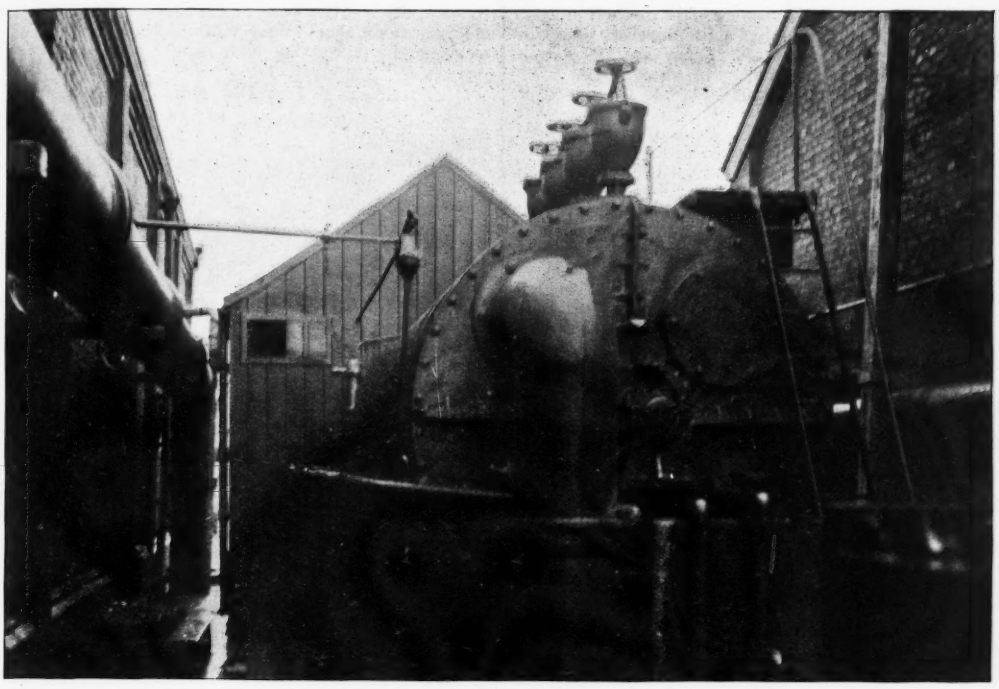
self-oiled gun-metal bearings. Built into the top of the frame, and forming part of it, is a large fixed hopper carrying 5 tons of coal. The frame is propelled by means of an electric motor attached to a gearing-box, which is bolted to the main channels of the frame. The whole of the gear is machine cut, and consists of spur-wheels and pinions. The only worm and wheel gear on the machine is that for hoisting the projector from tier to tier; and the wheel in this case is of gun-metal, with reversible ring. Worm gear is used for safety, as the worm is of such a pitch that it will not run back under the load. A claw-clutch, worked from the driver's platform by a hand-lever, puts into operation either the propelling or hoisting gear as desired; and the reversal of the motor determines the direction of the propelling or the hoisting or lowering of the projector.

The demonstration was undertaken personally by Mr. Jenkins; but he laboured under a disadvantage. It was seen, by actual work, that he could charge the 20-feet retorts easily in 20 to 22 seconds; and it was explained that the power required was not above 3 brake horse power. The disadvantage which the demonstrator suffered, and which caused a little hitch in completing the charging of the retorts right up to the mouthpiece, was that, owing to a serious breakdown in the main shafting at the Retford works during the previous week, the makers were unable to finish the mechanism of the measuring-chamber in time for the meeting; and consequently the weight of coal being charged was not definitely known. But the charges—which were about 6½ cwt. ones—were so regular and even that very little difference in weight could have occurred; and the improvement in the charging which may arise from the use of the measurer will be more in the nature of a check on the men than a necessity of the machine. The time allowed for the completion of the machine after the Gas Committee had consented to allow the makers to exhibit it was so limited that only the bare necessities to show the projector in a ction could be furnished. The machine was operated by electric current generated by a 9-horse power dynamo, driven from the steam-engine of a coal-breaker already erected in the retort-house. After passing the switch-board, the current is taken to a bare copper wire stretched overhead near the machine from end to end of the retort-house. The return circuit is managed in the same way; the conductors being side by side and 6 inches or so apart. There are two intermediate supports for the wire in the length of the retort-house; and a very simple arm fixed to the machine, and fitted with sliding contact-pieces, enables the current to pass to the starting switches on the machine. Cold as well as hot retorts were charged; and the result was that the machine was generally very favourably regarded by those who witnessed the demonstration. Before leaving the machine, Mr. Smith impressed upon those present the point that, under this system of working, the charging was accomplished from one side of the bench only, and thus only one charging-machine was required.

OTHER FEATURES: THE CYANOGEN PLANT.

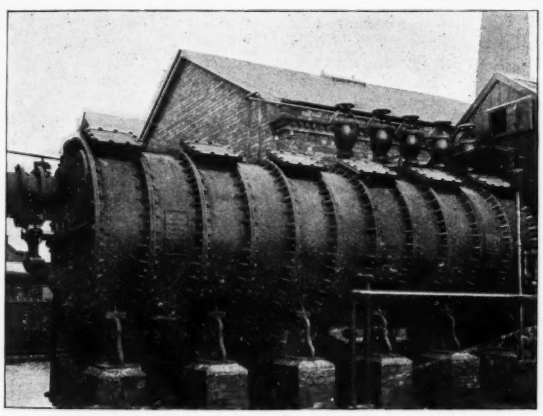
Passing on to No. 1 retort-house, the West compressed-air machinery which was installed at the time of the conversion last year came in for inspection; and a good deal of time was spent in viewing the operation of the De Brouwer coke-conveyors in this house—right away to the stages of mechanical sorting and loading into canal barges and carts. This is the house, stoking machinery, and coke plant to which the figures already quoted refer.

Leaving these interesting features, the party was conducted to the workshops and men's rooms; and noteworthy points of other portions of the plant were brought to attention *en route*. Passing the gasholders, it was mentioned by Mr. Smith that, for years before he entered into charge of the works in 1901, the holders were tarred. The Gas Committee had since sanctioned their painting throughout; and nowhere could it be seen that the tar was showing through. The inspection of the well-equipped



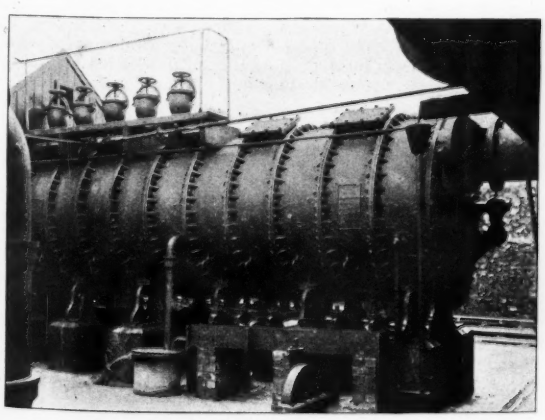
No. 1 Washer, 1½ Million Cubic Feet Capacity per Day.

This is part of No. 1 Section, and has been converted into Half for Cyanide, and the other Half left for Ammonia Extraction. The Inlet End of the Washer is seen.



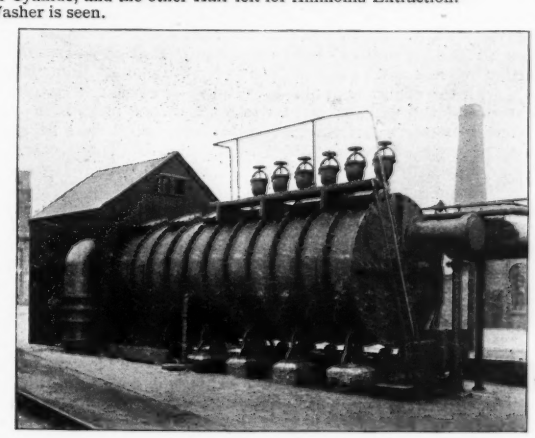
No. 2 Washer (Part of No. 1 Section of Works), 750,000 Cubic Feet per Day.

This gives the view as in No. 3. Supply and Overflow Pipe of Cyanide Washer—One Overflow is placed in the middle of the Washer, and the liquor works in the opposite direction to the usual Ammonia Washer, as it has been found by the experiments to work better, and not choke up.



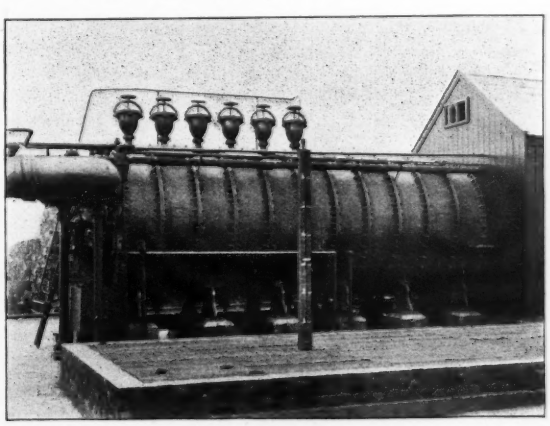
No. 2 Washer—Opposite Side.

Showing the Outlet End for clean gas, after the Ammonia has been extracted, the clean water supply, and the overflow for the Ammoniacal Liquor.



No. 3 Washer of No. 2 Section of Works, 1 Million Capacity per Day.

The Hopper end is the entrance for the gas, and when the Granular Sulphur is added for the Cyanide Extraction, the other part with the plain bays is for Ammonia Extraction—showing also the Engine-House for driving.



No. 3 Washer—Opposite Side.

This shows the Overflow of Cyanide Liquor; also the underground Store-Tank, with Measuring Float, into which the Sulpho-Cyanide of Ammonia Liquor is collected from all three washers by gravitation. It is pumped from this tank to an overhead Sales Measuring Tank.

workshops completed, the question of cyanide extraction next called for attention. Mr. Smith has put down a plant of very respectable extent for this purpose. From the information given by him, it was learned that the process (which, by the way, is under the patent rights of the British Cyanide Company, of Oldbury, whose Chemist, Mr. Horace W. Crowther, assisted in giving explanations), has been in operation at the works since about the beginning of May last, and up to now has fully realized the expectations of the Engineer. The amount of cyanide extracted has been upwards of 90 per cent. of the total quantity contained in the gas. The action of the washer is simplicity itself, giving no trouble whatever but the feeding once a day with granular sulphur. The overflow is so arranged that the liquor gravitates direct into the storage tank, ready to be pumped away to the contractors' boats or trucks, as the case may be. One advantage found is that the extraction of the cyanide from the gas gives the oxide, if used, a longer lifetime than before. The oxide was previously often sold for its prussian blue, which is now recovered by the process, and sold at a much better price to the British Cyanide Company than it would realize as prussian blue in the oxide, and fetches the full value for the sulphur contained, which was often formerly overlooked in selling the spent material on terms of the prussian blue alone. There is no wastage in the quantity of ammonia—in fact, the recovery is calculated to be greater on account of the ammonia becoming fixed in the cyanide compartments, and thereby reducing the amount of work for its final recovery.

As regards the working of the process, it has been found that it is necessary either to have a slight excess of ammonia in the crude gas over that required for the recovery of the cyanogen, or to feed the cyanide washer with ammoniacal liquor instead of water. Also that a large percentage of carbonic acid in the gas—exceeding 3 to 3½ per cent.—if not accompanied by a fairly high percentage of sulphuretted hydrogen, tends to lessen the recovery on account of the carbonic acid driving forward the sulphuretted hydrogen out of the liquor, and therefore decreasing the amount of polysulphides made. There is also, no doubt, a tendency in the process to reduce the sulphur compounds other than sulphuretted hydrogen. Up to now, however, the experience gained in working it, has not been sufficient to furnish full data as to the amount of these compounds that are extracted, since they are affected in the same way by the excess of carbonic acid. But if the carbonic acid is low, the recovery of the cyanides is greater, and the extraction of the sulphur compounds is proportionately better. Mr. Smith roughly estimated that he gets about 4½ lbs. of cyanide per ton of coal carbonized.

The Purifying Plant.

Attention was next directed to a 2 million oil-washer for arresting the naphthalene; and it was stated by Mr. Smith that he had not found this washing had any effect on the illuminating power of the gas. The new purifying plant was the centre of much interest and discussion. How Mr. Smith has obtained a large increase in his purification area by the replacement, in one of the houses, of the old boxes by new on Green's system was investigated; and then the conveying plant, by means of which the boxes are charged, and the spent oxide is carried away in the basement and elevated and distributed in the revivifying-house was also examined with great interest.

The following comparative figures will show the saving of time effected through dealing with the material by the aid of the conveyors. Mr. Smith claims that this economy in time represents something more to him than the mere money saving as shown by the accounts.

Cost of Emptying and Filling Purifiers by Hand and Machinery (No. 1 Purifier-House).

By hand, eight men—

86 hours emptying	£2	4	9		
63 hours filling	1	12	9		
	£3	17	6		
96 hours emptying	£2	10	0	£4	5 7 (average)
84 hours filling	2	3	9		
	£4	13	9		

By machinery, eight men and one youth—

60 hours emptying	£1	11	3		
Running machinery, &c.		12	5		
49 hours filling	1	5	6		
Running machinery, &c.		5	6		
	£3	14	8	3 14 8	
				£0 10 11	

These notes exhaust the special features of the works which have not previously been dealt with to any extent; and those to which we have here particularly called attention were alone fully sufficient to cause the members to feel that they were much indebted to the Corporation Gas Committee and their Engineer for the opportunity afforded for an inspection. It was indeed a liberal engineering treat, for there are few works in the country of similar magnitude to those at Walsall that have, within the space of the last two years, been changed so completely from the old form of working to the new, and with the operations dominated so largely by mechanical contrivances.

Dinner—A Few Points from the Speeches.

Two-and-a-half hours had been spent on the works. But the time had passed quickly and pleasantly; and shortly after three o'clock, the company were driven to the Dragon Hotel, where they were entertained at dinner. There were subsequently a few toasts; and from the speeches, some interesting extracts may be made. It fell to the President to propose "The Town and Corporation of Walsall." In his remarks, Mr. Meiklejohn did not overlook two important historical facts—one was that the original proposer of the Midland Association was the former Gas Engineer of the Walsall Corporation (Mr. John Tindall), and the other that from Walsall sprang the inventor of the prepayment meter, one of whose brothers is now the Chairman of the Corporation Gas Committee, and the other the Chairman of the Electricity Committee. In apt words, which were heartily endorsed by all, the President expressed his own appreciation and that of the members of the great kindness of the Mayor and Corporation. The toast was responded to by the Mayor. Then a special toast was accorded the Gas Committee; and it was submitted by Mr. Thomas Glover. Remarking upon the gas-works, he said he had no doubt all the engineers present had come to the conclusion that there must be a great deal of wisdom embodied in the Gas Committee of the Walsall Corporation, inasmuch as they had given their Engineer such a free hand to bring the works up to date. He felt that the Committee must be quite as satisfied with the results as their visitors had that day been delighted with the perfection to which the works had been brought. The mechanical appliances were beyond what they would see at many works. Though they might go many miles, and see many towns, he did not think they would find so many good mechanical appliances, dealing with large quantities of raw material and residuals, concentrated in one works of like dimensions. The toast having been honoured, Alderman T. P. Brownhill, the Chairman, responded in a racy speech. It was gathered from his remarks that in twenty years something like £120,000 had been transferred from the gas profits to the relief of the rates; that by the Corporation agreeing to the expenditure of £50,000 on the gas-works, they had, following the advice of Mr. Smith, been brought from a low-water mark to nearly the high-water mark; and that a temporary deficit had been turned into a handsome profit. He also mentioned that his brother who invented the prepayment meter was at one time Chairman of the Gas Committee; then another brother occupied the position; and now he himself had filled it for nine years. The second brother referred to—Alderman W. Brownhill—although now Chairman of the Electricity Committee, showed his generous disposition by proposing the toast of "The Midland Association of Gas Managers;" and he did it in very felicitous terms. Responding, the President made a few remarks on the competition of electricity and gas; observing that all gas managers asked for was that there should be a fair field and no favour. The last toast the President-Elect (Mr. George Helps) had the privilege of proposing. In it, he coupled the visitors and the Corporation Gas Engineer, and named for the response Mr. Kenneth Chance (who, he observed, came from a well-known stock of scientists, and whose father, Mr. Alexander Chance, was highly honoured) and Mr. Smith, both names being very heartily applauded. Mr. Chance took the opportunity to refer to some "Journal" remarks on the paper, published on July 7 last, by Mr. George E. Beilby, on "The Position of the Cyanide Industry." The sentence he especially laid hold of was this: "The paper is one which it may be well for all gas engineers to pause over who are considering the question of amalgamating with their present working a system of separating the hydrocyanic acid from their coal gas; for it will be merely waste of money and labour to adopt the system if there is no profit in it." This, said Mr. Chance, was such an obvious truth that it needed no comment. But he ventured to think that the terms the British Cyanide Company had offered would show a profit. They had offered a term of several years' contract; and this gave gas managers time not only to pay for the scrubber, but he hoped to make a little profit as well. The speaker, however, went on to point out that the consumption of cyanide, as shown by Mr. Beilby, was strictly limited, especially in the present state of affairs in South Africa; and it looked as if it would remain limited for some time to come. In view of this, the Company could only grant a limited number of licences; and they had been granting a good many lately. Mr. Smith, who was received with loud applause, sincerely thanked the members for the appreciation they had shown of his efforts for the meeting. Whatever he had done had been a pleasure, and had been undertaken in the interests both of the profession and of himself. Referring to the new projector, he characterized it as a most perfect means of charging retorts; and he had no hesitation in recommending, as he had done previously, his Committee to adopt the system in future extensions of the retort-houses. As to the cyanide extraction process, this also had given him entire satisfaction.

At the conclusion of the speeches, the members separated—all, it may be confidently said, being fully satisfied with the interesting day they had spent in Walsall.

THE POLICY OF GAS ENRICHMENT.

[ILLUSTRATED BY LONDON PRACTICE.]

By Arthur Graham Glasgow, M.E., M.Inst.C.E.

A Paper read before the American Gaslight Association Oct. 21.

Prefatory Note.—The author has added the above bracketed phrase to his title, because he believes that greater interest will attach to this statement if the general consideration of the subject be supplemented by specific figures showing the value *versus* the cost of enhanced quality; and the present London situation offers opportune facilities for such specific comparison.

The three London Gas Companies (each of which has a separate and distinct district) were formerly required to supply gas giving the luminosity of 16 standard candles, when burned in the "London" argand at the rate of 5 cubic feet per hour.

In 1900, the South Metropolitan Gas Company sought and obtained parliamentary sanction to supply gas of 14-candle power (when reduced to 5 cubic feet hourly), tested at 16 candles luminosity—*i.e.*, when burning at the rate of 5·7 + cubic feet per hour.

The Commercial Gas Company obtained similar rights in 1902-3, leaving the Gaslight and Coke Company (supplying about 60 per cent. of the London consumption) as the sole Metropolitan purveyor of 16-candle power gas.

The witnesses employed by the South Metropolitan and Commercial Gas Companies, in support of their 14-candle power standard, so decried the value and proclaimed the evil of the additional 2 candles luminosity, that the London County Council (originally opposed to the reduction in quality) promoted an amendment in the session of 1903 to compel the Gaslight and Coke Company, *inter alia*, to adopt a 14-candle power standard, with a compulsory reduction of 2d. per 1000 cubic feet in the price of gas. Unfortunately, this amendment was withdrawn, owing to concessions by the Company in other directions; and the opportunity of ventilating this question in Parliament was lost.

The South Metropolitan Gas Company and its allied Commercial and Crystal Palace Companies have formulated a parliamentary case for low grade gas with zeal and even with vehemence; but no gas undertaking has yet been required to traverse their arguments and establish the case for enrichment. For that reason, the author is encouraged to offer this small contribution to the common knowledge.

As destruction is easier than construction, so it would be, perhaps, easier to destroy the fabric of evidence erected in support of the reduced standard, than to specifically measure the advantage of supplying the higher quality of gas. Nevertheless, the latter task appears to present so little difficulty that it is attempted within the limit of this communication.

An intelligent discussion of gas enrichment manifestly requires a preliminary understanding of the various methods of enrichment.

The question of coal-gas enrichment began to assume an acute stage in the United Kingdom more than fifteen years ago, owing to the diminishing supply and increasing price of cannel. If the use of cannel were the only mode of enrichment now available, the great majority of gas consumers would unquestionably be better served by unenriched coal gas, of the natural quality produced by the most available gas coals. Cannel enrichment is generally played-out; the candle is not worth the game.

The "vapour-enrichment" of coal gas is an unreliable makeshift, designed to satisfy official tests rather than as a means of practically benefiting the consumer. As usually applied, this method consists in injecting hot vapour of benzol into the gas as it enters the distributing system; but whether any of this condensable vapour reaches the consumer depends upon conditions over which the gas manager has no control.

A consideration of the nature of benzol will indicate the essential defect in this method of enrichment. Commercial 90 per cent. benzol is a liquid mixture of benzene (C_6H_6), toluene (C_7H_8), xylene (C_8H_{10}), &c., of the aromatic series (C_nH_{2n-6}). Its specific gravity is about ·880, and its initial boiling point about 180° Fahr. Some 90 per cent of the mixture distils below 212° Fahr. Below 180° the natural condition of this benzol is liquid, just as below 212° the natural condition of water is liquid. Above 180°, it begins to volatilize; and at 212° Fahr. it is 90 per cent. vapour, just as steam is aqueous vapour. If the temperature be subsequently reduced below 180° Fahr., the benzol vapour will again become liquid, just as steam will again condense to water below 212°. In other words, benzol cannot exist in the form of a permanent gas, but becomes partially vaporous or entirely liquid according as the temperature is above or below 180° Fahr. Thus the attempt to supply the consumer with substantial enrichment, by injecting hot benzol vapour into the gas leaving the works, is somewhat akin to an endeavour to supply him with heat by admitting steam to this issuing gas.

But just as air may contain aqueous vapour to a degree of humidity known as the point of saturation or "dew-point," so any gas may be saturated with benzol vapour. This amount of enrichment may be regarded as permanent so long as the temperature is not lowered. The "dew-point," however, depends absolutely upon the temperature. If gas, saturated at one temperature, be subjected to further cooling in the distributing system, a corresponding deposition of enriching vapours will ultimately take place, just as dew condenses after sunset.

Now unenriched coal gas is already saturated with benzol and co-solvent hydrocarbons to a degree dependent upon the method of condensing, and the co-ordination of temperatures during manufacture, storage, and distribution. Such gas frequently contains 95 per cent. of the total benzol produced during the distillation of the coal. Therefore, to inject any considerable additional quantity of artificially heated benzol vapour into the outlet gas creates an excess load which the gas cannot permanently carry, although some of this surplus vapour may be kept suspended in a state of fog during its travel through the trunk mains and larger arteries.

Sir George Livesey, in his paper on "The Enrichment of Coal Gas," in May, 1900, gave the following experience of vapour enrichment: "Reliable evidence as to its want of efficiency is furnished by the fortnight's experiment in 1894, when all of the South Metropolitan gas was sent out unenriched, and the succeeding fortnight, when it was enriched with spirit as usual. The tests by the portable photometer were practically the same in both cases. The portable photometer results—although, as an instrument, it corresponds exactly with the official photometer—cannot be accepted as accurate, because the instrument is used under improper conditions. Still, when compared with itself under similar conditions (as in these two series of tests), the comparison holds good. Therefore, if this complete practical experiment gave, as is believed, reliable results, the conclusion is inevitable, that enrichment by spirit vapour is useless, and simply a waste of the consumers' money."

This emphatic declaration of the Chairman of the South Metropolitan Gas Company is corroborated by recent parliamentary evidence of Dr. Frank Clowes, the Chief Chemist and Superintending Gas Examiner to the London County Council. Dr. Clowes stated that his special tests of South Metropolitan gas, as it reached various important consumers, averaged 14·68 candles under the former 16-candle standard, and 14·26 candles under the present 14-candle standard; whereas, according to the Company, the works and official tests during the same periods averaged:—

	Works.	Official.
Half year to June, 1901	16·77 ..	16·58
,, ,, 1903	14·70 ..	14·75

It may be added that even the scant half-candle difference found by Dr. Clowes cannot be credited to the vapour-enrichment, inasmuch as the natural coal gas was made in smaller volume per ton, and consequently of higher quality, when the higher standard was in force.

This ineffectual vapour enrichment cannot, therefore, be accepted as a practical substitute for cannel enrichment. Hence those who will recognize no other alternative are correct, within their limitations, when they compound with Parliament for the abolition of enrichment; and Parliament, within similar limitations, is justified in abolishing a system of enrichment whereby it is admitted the consumer pays for goods not delivered. It is evident, however, that such cases are an argument—not against enrichment, but against *failure to enrich*.

Broadly speaking, there is now but one intelligent method of enriching coal gas—namely, by the admixture of carburetted water gas of higher quality. Therefore it may be well to recite some of the special features of that product and process, even at the risk of being considered elementary.

Carburetted Water Gas.

Chemically, there is no such gas as carburetted water gas or coal gas. These are commercial terms designating the products of two industrial processes, each yielding a complex mixture of a number of individual gases. Furthermore, in spite of the different apparatus, processes, and raw materials employed, there is no appreciable difference in the *qualitative* analyses of these two products.

That known as carburetted water gas contains only the elements present in coal gas; and the two products may be mixed in any desired proportion to form an intermediate product, quite as homogeneous as either of the originals, and with quite as much right, chemically, to a distinctive name. In other words, the names serve to distinguish the dissimilar methods of production, rather than the manufactured products.

In considering enrichment by carburetted water gas, three essential features must be first grasped—

(*a*) Carburetted water gas is not merely a means of enrichment, but is a saleable gas, in every respect as suitable as ordinary coal gas for general distribution *per se*. Simple enrichment of otherwise finished coal gas necessarily means additional expense; whereas the admixture of carburetted water gas displaces an equal bulk of coal gas. If this enriching water gas be as cheap as the unenriched coal gas, the cost of the enrichment is *nil*, compared with the coal gas *per se*.

(*b*) Unlike coal gas, the higher the candle power of carburetted water gas—within the practical limit of (say) 35 candles—the cheaper is its cost per candle. On this feature depends its peculiar facility for enriching coal gas by admixture therewith.

(*c*) The joint manufacture of carburetted water gas and coal gas results in striking reflex economies in the cost of the coal gas, through what are known as the "collateral" economies of carburetted water gas.

These collateral advantages of carburetted water gas may be summarized as follows:—

(1) Saving in first cost of works. Excluding the distributing system, but including storage holders, the cost of large carburetted water-gas works *per se* is about two-fifths that of coal-gas works. When auxiliary plant is dovetailed into existing coal-gas works, the relation is more favourable to carburetted water gas.

(2) Small ground space occupied. The space needed for carburetted water-gas works *per se* is about one-third that needed for coal-gas works. But when carburetted water-gas plant is installed as an auxiliary in coal-gas works, no facilities are needed for the receipt and storage of fuel; and the displacement and consumption of coke usually save coke storage space sufficient for the generating plant.

(3) Wear and tear. This total expense is about 1¼d. per 1000 cubic feet of carburetted water gas, compared with 3½d. in coal-gas manufacture.

(4) Availability. In case of need, reserve plant is immediately available, contrasted with the several days needed to bring coal-gas benches into action, and the ensuing expensive repairs. The plant can be brought, without injury, from a cold state into full efficiency in three hours. It can be kept under slow fire without appreciable expense, and can then be in free use within the hour. By thus taking up the inequalities of consumption, and meeting emergencies otherwise borne by the retort-house, the process diminishes the repair charge for coal gas, and reduces the necessary gasholder capacity. Reserve plant for the same daily volume usually costs less than holder and tank, and meets a prolonged demand with a continuous profit-earning supply, whereas an emptied holder is unproductive.

(5) Increased prices for coke. By creating a demand on the works for coke issuing from the retorts, checking the production of coke in proportion to the coal gas displaced, and avoiding labour and losses of stacking and handling.

(6) Approximate independence of coal supply. The surplus coke from each 1000 cubic feet of coal gas produces about 3000 cubic feet of carburetted water gas. In other words, the make per ton of coal carbonized may be increased from 10,000 to 40,000 cubic feet. The use of carburetted water gas enables the illuminating power of the coal gas to be sacrificed for a greater yield per ton of coal, and thus reduces the cost of the coal gas per 1000 cubic feet. In the same way, it affords free choice of gas coals, and relatively increases the gas-coal supply by reducing the demand. The importance of the two preceding features is illustrated by the following British figures: The present consumption of gas coal in the United Kingdom—about 14 million tons per annum—would be increased by one-seventh, or 2 million tons annually, if it were not for the auxiliary manufacture of carburetted water gas. In view of recent coal markets, it is impossible to estimate the result with gas coals if this increased demand had existed. But it may be stated that, with an average of 33 per cent. of carburetted water gas, a saving of 5d. (10 c.) per ton of gas coal compensates 1d. (2 c.) per 1000 cubic feet in the cost of the carburetted water gas. Likewise, a market would have to be found for 1,400,000 tons of additional gas coke per annum, if it were not for the manufacture of carburetted water gas. In this respect, coal gas works are now in a somewhat anomalous position, for they purvey both gas and coke for the same domestic purposes. The coke is sold at cost price, as far as comparison with the cost of coal gas is concerned (since the whole revenue from coke is credited to that gas); but it competes with the very gas from which all profit is derived. Therefore, the 1,400,000 tons of coke, if thrown annually on the market, would tend to demoralize the present condition of the industry. It may be added that with 33 per cent. of carburetted water gas, an increase of 10d. (20 c.) per ton in the price of coke compensates 1d. (2 c.) per 1000 cubic feet in the cost of the carburetted water gas.

(7) Approximate independence of labour. For a comparison between carburetted water gas generating labour and coal gas carbonizing labour (including boilers and exhausters in both cases), upon the same basis and on a large scale of operation, the author would take the following general ratio :—

Carburetted Water Gas.	Coal Gas.		
	Inclined Retorts.	Machine Work.	Hand Work.
1	3·5	4	6 to 7

The general labour is also greatly reduced.

(8) Instant control of illuminating and calorific power—in case of variation in coal or other emergency—by simply changing the oil supply.

(9) Prevention of naphthalene deposits. When mixed with coal gas, carburetted water gas acts as a solvent vehicle for naphthalene. With a properly made carburetted water gas, naphthalene is unknown; and if a sufficient percentage of carburetted water gas of good quality be mixed with coal gas, it will largely or entirely prevent the precipitation of naphthalene from the coal gas.

(10) Permanence. If one thing has been thoroughly demonstrated regarding modern carburetted water gas, it is essentially its permanence in distribution. The author's ample experience has convinced him that carburetted water gas of 50 per cent. higher luminosity is more permanent than unenriched coal gas. This he ascribed to the process of production, whereby certain condensable vapours—mainly benzene and naphthalene—are replaced by permanent gases.

(11) Improved combustion. Unlike other enrichers, carburetted water gas may be freely burned in ordinary flat-flame burners with less soot and noxious products than is the case with ordinary coal gas. This, as just stated, is due to the process of production whereby certain coal-gas vapours are replaced by permanent gases, and to the action of its carbonic oxide in promoting combustion. It is beginning to be recognized that similar benefit is realized in incandescent gas lighting.

(12) Small proportion of sulphur. Crude carburetted water gas contains from one-fifth to one-tenth the sulphur usually present in crude coal gas; and, as this is almost exclusively in the form of sulphuretted hydrogen, simple oxide purification eliminates it almost completely.

The last two features govern a question of importance. The most rational basis for a sanitary comparison of ordinary town gases is probably with reference to their products of combustion, especially in view of the increasing use of flueless gas-stoves. The entire population of every town is concerned with the purity of the products of combustion of the gas supplied, whereas those affected by the accidental escape of unconsumed gas represent an insignificant percentage, compared with the accidents attaching to other interests of similar extent. This view is reflected in the parliamentary restrictions upon the quantity of sulphur permissible in London gas, although the limits have been fixed by the manufacturing possibilities of coal gas—not by the degree of purity desirable. As it is undoubtedly a fact that one of the principal causes (if not the chief cause) of the wide substitution of electric lighting for gas lighting is the character of the products of combustion of the gas, the importance of improvement in this direction cannot be easily magnified.

From the above statement of collateral advantages, it is evident that a comparison of the ordinary book-keeper's accounts, when coal gas and carburetted water gas are made concurrently, does not disclose the financial benefit resulting from the auxiliary manufacture of carburetted water gas, inasmuch as this auxiliary effect is to reduce the cost of the coal gas in many ways. Not only do the collateral economies go to the credit of coal gas in the accounts, instead of being credited to the carburetted water gas, to which they are due, but the expenses by which they are accomplished (including the coke used by the process, at the enhanced price due to the use of the process) are charged against the carburetted water gas—thus doubly affecting the comparison of costs *as shown by the accounts*.

In a paper read before this Association in 1899, the author endeavoured to establish a truer comparison, by reducing certain of these economies to their financial equivalents. Considering, however, merely *the interest on first cost of works* (which is as necessary a part of the selling price of the gas as is the coal or oil used in its manufacture), the difference in capital charges in favour of carburetted water gas was found to be over 2¼d. (4½ c.) per 1000 cubic feet, when each gas is made and distributed *per se*. But when carburetted water gas was treated as an auxiliary to coal-gas manufacture (to the extent of one-third the maximum weekly production), this difference in interest became more than 4½d. (9 c.) per 1000 cubic feet of *carburetted water gas produced*.

The following figures give, approximately, the proportion of carburetted water gas now manufactured. The present annual output of town gas manufactured by the English-speaking race is:

	Cubic Feet per Annum.
United Kingdom	160,000 millions.
Australasia	5,000 ,,
British Possessions	800 ,,
Canada	2,500 ,,
United States	90,000 ,,
	258,300 millions.

Of this total volume of manufactured gas, one-third (86,000 millions) is carburetted water gas. Of this 86,000 million cubic feet of carburetted water gas, about 20,000 million cubic feet, or 23 per cent., is now being manufactured in the United Kingdom.

Question of Quality.

It is now advisable to consider briefly the general question of quality. The gas industry has no longer a monopoly, though it retains monopolistic superstitions. It must struggle for existence under the general laws governing industry and commerce, the fundamental requirement of which is to give the greatest value for the least money. In Great Britain, what Parliament may be induced to grant is becoming less important than what the consumer may be induced to use. Parliament may authorize business, but whether it will be worth continuing depends upon the consumer.

The broad question, therefore, is not whether 14 or any other candle power of gas is "good enough," but by what quality of gas, *as a vehicle*, can the maximum pecuniary equivalent in light, heat, and power be delivered to the consumer? The catch-cry, "Cheap Gas!" is very like the free-silver slogan, "Cheap Money!"

Gas, *as gas*, has no value to the consumer—its whole value depends upon its ability to convey and develop useful energy; and that gas is cheapest which provides the maximum energy at the minimum price. That mission being fulfilled, the price per 1000 cubic feet of the gaseous vehicle is a matter of indifference.

A reduction in the cost of gas, when its quality (calorific and illuminating) is maintained, is an unqualified saving; but any method of "cheapening" gas, by reducing its quality, needs to be carefully weighed in order to discover if the real result be gain or loss.

Cost of Enrichment.

This question has two aspects, according to whether it is desired to find: (1) the cost of enriching an existing supply of ordinary coal gas, or (2) the cost of increasing the quality of an existing mixture of coal gas and carburetted water gas.

In the first case, the comparison—as with other methods of enrichment—is between the cost of the coal gas before enrichment, and the cost of the enriched mixture. It involves an exact knowledge of: (*a*) the cost of coal gas, (*b*) the proportion of carburetted water gas to be used, and (*c*) the cost of the carburetted water gas of the proper enriching quality. But (*b*) and (*c*) are interdependent—that is to say, the greater the proportion of carburetted water gas, the lower its requisite candle power and the less its cost. For instance, to enrich 14-candle power coal gas to 16 candles requires 10 per cent. of carburetted water gas of 34-candle power, or 50 per cent. of carburetted water gas of 18-candle power. The difference in the London cost of 34 and 18 candle carburetted water gas is about 5d. (10 c.) per 1000 cubic feet—say, for instance, 18d. (36 c.) and 13d. (26 c.) respectively. The London cost of 14-candle power coal gas averages, say, 14d. (28 c.) per 1000 cubic feet. Then the enriched 16-candle power mixed gas costs, with the 34-candle enricher, 14·4d. (28·8 c.) and, with the 18-candle enricher, 13·5d (27 c.) per 1000 cubic feet. The "cost" of enrichment is, in this case, a saving or a charge, according as the greater or less proportion of carburetted water gas is used. This reasoning often explains discrepancies in the reputed saving or expense of enrichment by carburetted water gas. When, however, the cost of the carburetted water gas of the required town standard (16 candles) exceeds the costs of the unenriched coal gas, the enrichment is necessarily an expense. [For some further explanation, see "Journal of Gas Lighting," Vol. LXIV., p. 864].

But in the specific case of the Gaslight and Coke Company, the expense of enrichment is a simple question. This Company is already supplying a mixture of coal gas and carburetted water gas in given proportions. Its district standard is now 16 candles, and it is proposed to reduce it to 14 candles. It is necessary only to know the manufacturing saving due to this proposed reduction of 2 candles.

Assuming the entire enrichment to be by carburetted water gas, with oil at the somewhat high average price of 3d. per gallon, the manufacturing saving will be one-third of a penny per candle, or two-thirds of a penny total manufacturing saving.

Value of Enrichment.

It is now necessary to ascertain, and compare with the above saving in cost, the loss in useful effect of the same volume of gas, due to the reduction in quality from 16 to 14 candle power. The loss in useful effect will be different, according to the use that is made of the gas—viz.: (*a*) Where the calorific power, pure and simple, is utilized as in stoves and engines. (*b*) Where the incandescent effect is utilized as by the Welsbach mantle. (*c*) Where the flame luminosity is utilized as in ordinary burners. The nominal loss in luminosity between 14 and 16 candle standards, tested in official argands, is, of course, 12½ per cent.; but the actual loss in flat-flame burners is far greater.

Elaborate determinations have been made, by numerous skilled observers, of the 16-candle power gas as actually supplied by the Gaslight and Coke Company, compared with a similar mixture of 14-candle power, tested by the method prescribed for the 14-candle power gas of the South Metropolitan and the Commercial Gas Companies. The following results, verified by the author, are taken as representative.

I.—WITH "C" WELSBACH BURNER.

The 16-candle power district gas and the special 14-candle power gas consisted of two-thirds coal gas and one-third carburetted water gas, in each case. The same ordinary (or "C") incandescent Welsbach burner (and mantle), as generally supplied in London, were used throughout. Each gas was burned at the rate best suited to the burner, without modification of gas-nozzle. The air was especially regulated to give the best effect with the 14-candle power gas; but the burner was used unregulated, as supplied to the trade, with the 16-candle power district gas.

14-Candle Power Gas.

	Candles.
(1) Illuminating power (in "London" argand, at 16 candles luminosity, chimney 6 in. by 1⅛ in., reduced to 5 cubic feet rate)	14·40
(2) Incandescent effect (maximum light per cubic foot—rate 3·9 cubic feet per hour, air supply diminished)	20·30
	B.T.U.
(3) Calorific power (Junkers calorimeter)—Gross value	582·00
" " " " Net "	529·00

16-Candle Power Gas.

	Candles.
(4) Illuminating power (in "London" argand, at 16 candles luminosity, chimney 6 in. by 1⅛ in., at 5 cubic feet rate)	16·34
(5) Incandescent effect (maximum light per cubic foot—rate 3·45 cubic feet per hour, air unregulated)	22·70
	B.T.U.
(6) Calorific power (Junkers calorimeter)—Gross value	628·00
" " " " Net "	567·00

Summary.

Difference in illuminating power	1·94 cls.
Loss in calorific power, 38 B.T.U.	6·70 p.c.
Loss in incandescent effect, 2·4 candles per foot	10·57 "

II.—WITH "EDINBURGH" WELSBACH BURNER.

The 16-candle power district gas and the 14-candle power gas consisted, as before, of two-thirds coal gas and one-third carburetted water gas, in each case. The same ordinary "Edinburgh" Welsbach burner (and mantle) were used throughout. Each gas was burned at the rate best suited to the burner, without modification of the gas-nozzle. The air was regulated to give the best effect with each gas.

14-Candle Power Gas.

	Candles.
(1) Illuminating power (in "London" argand, at 16 candles luminosity, chimney 6 in. by 1⅛ in., corrected to 5 cubic feet rate)	14·80
(2) Incandescent effect (maximum light per cubic foot—rate 3·35 cubic feet per hour, air supply diminished)	21·40
	B.T.U.
(3) Calorific power (Junkers calorimeter)—Gross value	582·40
" " " " Net "	526·80

16-Candle Power Gas.

	Candles.
(4) Illuminating power (in "London" argand, at 16 candles luminosity, chimney 6 in. by 1⅛ in., at 5 cubic feet rate)	16·70
(5) Incandescent effect (maximum light per cubic foot—rate 3·35 cubic feet per hour, air supply diminished	24·90
	B.T.U.
(6) Calorific power (Junkers calorimeter)—Gross value	623·50
" " " " Net "	564·50

Summary.

Difference in illuminating power	1·90 cls.
Loss in calorific power, 37·7 B.T.U.	6·68 p.c.
Loss in incandescent effect, 3·5 candles per foot	14·00 "

III.—WITH FLAT-FLAME BURNERS.

14-Candle Power Gas. (14·80 *C.P.*)

(1) 14-candle power (parliamentary) Sugg governor burner; illuminating power for 5 cubic feet	11·40 cls.

16-Candle Power Gas. (16·66 *C.P.*)

(2) 16-candle power new Sugg governor burner; illuminating power for 5 cubic feet	15·77 "

Summary.

Difference in official illuminating power	1·86 "
Loss in flat-flame burners, at 5 cubic feet rate per hour, 4·37 candles	27·70 p.c.

The above values are believed to represent practical use; but there are two features which must qualify the general application of all figures connecting incandescent effect with illuminating power.

(1) Illuminating power is not a true criterion of calorific power or flame temperature, and, consequently, not of incandescent effect. Therefore, comparisons of this nature are accurate only when the base composition of the gas (*i.e.*, the diluents, H, CO, and CH_4) remains relatively the same, and the difference in candle power is due to a regular increase in the natural proportion of heavy hydrocarbons—in other words, when the comparison is between the two different qualities of the same gas, as it were, which, after all, is the real point in question.

(2) Neither illuminating power nor incandescent effect are absolute quantities. They both depend upon the burner used and the method of testing.

This latter point is now well recognized in standard tests of flame luminosity. The difference between the argand burners prescribed for official testing in London, and in Brentford, Wandsworth, Salford, &c., represents an increase of about 2 candles in the official quality of London 16-candle gas; while, with the prescribed "London" argand, a carburetted water gas of 20-candle power, when burning at the rate of 5 cubic feet per hour, will lose nearly 2 candles when tested at 16 candles luminosity. There is greater difference with flat-flame burners.

But, in incandescent gas lighting, the proper adjustment of burner and gas is everything. The first principle underlying the application of gas to incandescent lighting is to use it under proper conditions of combustion. Otherwise, comparison is not only futile but grossly misleading.

For instance, the ordinary "C" Welsbach burner (owing to its low candle power origin) is less efficient with London 16-candle power coal gas than with London coal gas of 14-candle power. The remarkable failure to see that this is due to defects in the

burner—*not* in the gas—has been chiefly responsible for the recent mistaken movement in favour of low-grade gas, and for the hitherto successful attempts to influence parliamentary legislation by means of such mischievous evidence as the "Dessau Diagram" of Messrs. W. von Oechelhaeuser and Schaeffer—"corroborated" by the South Metropolitan Gas Company ["JOURNAL," Vol. LXXV., p. 1201], and the results communicated by Dr. Bunte to the Paris Gas Congress ["JOURNAL," Vol. LXXVI., pp. 642-3], &c. In these comparisons, gases of widely different luminosity in flat-flame burners were used in *the same Welsbach burner under the same conditions of combustion, and were valued accordingly!* Those conditions, being suited to one quality only, gave the best efficiency only with that quality, and progressively poorer results according to the degree of variation from that quality. Moreover, the stated candle powers, with flat-flame burners, bore no practical relation to the composition of the gases, inasmuch as a normal coal gas was "benzolized," "stripped," or "doctored," in order to produce the other qualities.

It is common knowledge that gases of different composition and quality require different volumes of air for proper combustion, as well as different provision for proper mixture, before and during combustion, of these different proportions of air and gas. Moreover, the rate at which any gas is burned in incandescent lighting should be adjusted to the mantle so that the flame during combustion will exactly engage the mantle.* By observing these requirements, the Scott-Snell lamp was found by Mr. Morris to give an incandescent effect of 42 candles per cubic foot of 25-candle gas. [Proceedings of the American Gaslight Association, Vol. XIX, p. 307]; and Professor Lewes has obtained 146 candles by incandescence per cubic foot of acetylene. ["JOURNAL," Vol. LXXX., p. 1687.] On the other hand, by violating these fundamental essentials of bunsen combustion, Messrs. von Oechelhaeuser and Schaeffer have concluded that "a decrease of 86 per cent. (from 13 to less than 2 candles) in illuminating power with the old burner was attended by an increase of 11 per cent. with the incandescent burner." Likewise, Dr. Bunte found "that great changes in the composition of the gas, which reduce the illuminating power in flat-flame and argand burners by more than one-half, or considerably increase it, and likewise greatly alter the calorific value of the gas, produce only relatively small differences in the illuminating duty with the Welsbach burner." And upon "such a remarkable fact," he based a theory of bunsen combustion!

"And still the wonder grew," when leading British gas managers "corroborated" these irrational results, and influenced parliamentary legislation by means of evidence diametrically opposed to the scientific facts of the case. This would seem an instance of the credulous hospitality often accorded to statements that support predetermined conclusions.

But the "C" Welsbach burner, while inefficient with London 16-candle coal gas, is, nevertheless, fairly suitable (unregulated) for the London 16-candle mixture of two-thirds coal gas and one-third carburetted water gas. That is to say, this same burner is about equally adapted to the present South Metropolitan 14-candle coal gas and to the present Gaslight and Coke 16-candle mixed gas, and gives, with the latter gas, results about 10 per cent. higher than with the 14-candle coal gas. On the other hand, the "Edinburgh" burner—which in the matter of cost is a duplicate of the "C" burner—gives (unregulated), with 16-candle London coal gas, results nearly 20 per cent. higher than the "C" burner gives with 14-candle London coal gas; whereas the calorific difference in these two coal gases is about 8 per cent.

The foregoing determinations of loss in useful effect, due to the reduction from 16 to 14 candle power, may be conveniently restated in the following comparative table:—

Comparative Table.	Loss between 16 and 14 Candle Power.	
	By Above Determinations.	Basis for Succeeding Estimates.
Calorific power	6·70 per cent.	6½ per cent.
Incandescent effect	12·28 ,,	10 ,,
Flat-flame burners	27·70 ,,	25 ,,

ADVANTAGE OF ENRICHMENT.

At the present selling price of the Gaslight and Coke Company—viz., 3s. (75 c.) per 1000 cubic feet—this reduction from 16 to 14 candle power means for:

	Loss in Effect (Percentage)	Loss in Value (Per 1000 Cubic Feet).	Saving in Cost.	Net Loss per 1000 Cubic Feet.
Calorific power . . .	6½	.. 2·34d.	.. 0·66d.	.. 1·68d.
Incandescent effect . .	10	.. 3·60	.. 0·66	.. 2·94
Flame luminosity . .	25	.. 9·00	.. 0·66	.. 8·37

The net losses shown must be borne by the consumer, or by the Company, or by both jointly.

Assuming the output of gas to be utilized in the proportions given below, the *probable average loss between 16 and 14 candle power will be*—

	Volume.	Average Loss (Percentage).	Average Loss (Per 1000 Cu. Ft.
Calorific power . . .	40 per cent.	6½ per cent.	2·34d.
Incandescent effect . .	30 ,, ,,	10 ,, ,,	3·60
Flame luminosity . .	30 ,, ,,	25 ,, ,,	9·00
	100 ,, ,,	13·1 ,, ,,	4·71d.

Average Loss in Useful Effect.	Value of Loss per 1000 Cu. Ft.	Saving in Cost.	Net Loss per 1000 Cu. Ft.
13·1 per cent.	4·71d.	0·66d.	4·05d.

On the proposed basis of a compulsory compensation of 2d. in the price of gas for the two candles reduction in quality, this means a loss to the consumer of (4·71—2=) 2·71d. per 1000 cubic feet, and a loss to the Company of (2 — 0·66 =) 1·34d. per 1000 cubic feet. Or, reckoned on the Company's present sale of 21,000 million cubic feet, a loss to consumers of £237,000 ($1,150,000) per annum, and to the Company of £117,000 ($570,000) annually—being a total net loss of £354,000 ($1,720,000) per annum.

In the light of these figures, the Company could not intelligently adopt a 14-candle power standard, even were it authorized, without compensation to consumers. An expenditure of two-thirds of a penny for a present saving of probably 4·7d. to consumers, could not be considered other than a prudent and economical insurance of the stability of the business.

It is possible that the gradual evolution of more perfect burners may reduce the above discrepancy between the difference in calorific power (6½ per cent.), and the difference in incandescent effect (10 per cent.). But, inasmuch as the richer gas has also a somewhat higher calculated flame temperature—apart from its greater calorific power—it is not probable that this discrepancy will be altogether eliminated. If, however, this possible future change be discounted, by grouping incandescent effect with calorific power, and, moreover, the consumption allotted to flat-flame burners be halved, the minimum prospective loss, due to a reduction from 16 to 14 candle power, becomes—

	Volume.	Average Loss. (Percentage.)	Average Loss (Per 1000 Cu. Ft)
Calorific power . . . / Incandescent effect. .	85 per cent.	6½ per cent.	2·34d.
Flame luminosity . .	15 ,, ,,	25 ,, ,,	9·00
	100 per cent.	9·27 per cent.	3·33d.

Average Loss in Useful Effect.	Value of Loss per 1000 Cu. Ft.	Saving in Cost.	Net Loss per 1000 Cu. Ft.
9·27 per cent.	3·33d.	0·66d.	2·67d.

Hence this minimum future loss would be: To the consumer 1·33d. per 1000 cubic feet, or £116,000 per annum, and to the Company still 1·34d. per 1000 cubic feet, or £117,000 per annum—being a total annual prospective loss of £233,000, reckoned on the present output.

But under the practical operation of the parliamentary sliding scale (which establishes a community of interest between consumers and shareholders), the distribution of profits is in such relation to the price legally charged, that the consumers bear nearly the whole of the above losses—*i.e.*, the loss directly ascribed to them and about four-fifths of the loss ascribed to the Company. We have, therefore, the curious spectacle of the consumers' guardian (in the guise of the London County Council) promoting legislation, in the supposed interest of the consumers, the immediate effect of which would be a loss to the consumers of about 3·75d. per 1000 cubic feet of gas consumed. It has remained for the most maligned of English Gas Companies to successfully resist this wasteful movement—in opposition, not only to recent parliamentary precedents effected by acknowledged leaders of the industry, but to the local authority (representing the consumers), and to an influential section of the Technical Press.

If the foregoing values are correct, the case for 14 *versus* 16 candle gas in London falls hopelessly to the ground. It only remains, therefore, to ascertain whether the evidence advanced in favour of low-grade gas qualifies in any way the above conclusions. To this end (and somewhat by way of a summary of the preceding pages), it will suffice to traverse briefly the public arguments of Sir George Livesey, the Chairman of the South Metropolitan and Crystal Palace Gas Companies, a Director of the Commercial Gas Company, and undisputed leader in Great Britain of the current low-grade movement.

In his paper "The Enrichment of Coal Gas" (see *ante*, p. 219), Sir George Livesey states that there are "only three systems in general use;" with reference to cannel enrichment "its cost puts it out of court;" "enrichment by spirit vapour is useless, and simply a waste of the consumers' money;" "and carburetted water gas is objectionable from its nature and the difficulty and uncertainty of mixing."

Sir George Livesey has had wide experience with cannel and vapour enrichment; and the author fully concurs in the conclusions drawn therefrom. But facts permit carburetted water gas to be dismissed, in this fashion only by one who could also avow: "I know nothing of water gas and I am rather glad I do not" [Proceedings of the Institution of Civil Engineers, Vol. CXLVI., p. 83]—notwithstanding that carburetted water gas already forms one-third of all town gas manufactured by the English-speaking race (*ante*, p. 220).

To better gauge the bias that characterizes any improvement

* The author directs attention to the valuable papers from time to time communicated to the Michigan Gas Association by Professor A. H. White and his associates,

of common coal gas as "adulteration," let us imagine for a moment the original introduction of coal gas and carburetted water gas in the reverse chronological order. Suppose that the British gas manager had devoted his life to carburetted water gas, and that a foreign development called coal gas were being urged upon him. The argument in its favour would analyze somewhat as follows: It is true that the proposed coal gas requires twice the capital expenditure, three times the ground area, from three to six times the manufacturing labour, and large additional operations in residuals, since only 20 per cent. of the coal purchased can be converted into gas; moreover, the new gas is limited to (say) 14-candle power, and the individual services are subject to stoppages from naphthalene; the presence of benzene and naphthalene make it less permanent than the existing supply, and it contains many times as much sulphur; its combustion is less perfect, owing largely to the presence of less carbonic oxide; and it yields more offensive products; and, for the same quality, its average holder cost is generally more—often much more. But, against such disadvantages, *there is the satisfaction of supplying "unadulterated" coal gas, made from* [now increasingly scarce] *British coals!*

In these circumstances, who would even consider the *complete substitution* of coal gas for carburetted water was? Yet, an equivalent result prevails to-day in many of the British gas-works that do not practice the auxiliary manufacture of carburetted water gas. As already pointed out in detail (*ante*, pp. 219-20), this auxiliary manufacture of carburetted water gas not only affords a perfect means of enrichment, *but also largely eliminates the disadvantages of coal gas per se;* moreover, it realizes important opportunities that attach to the system of *dual manufacture*, and that are lost when either gas is made exclusively. One such feature is illustrated in Sir George Livesey's parliamentary testimony, May 3, 1900: "The crucial point is whether the consumers shall have gas at all—not whether it shall be a candle more or less. The largest gas-works in London were recently within six hours of exhausting their supplies of coal. We have been hovering for weeks on two days' supply; and what we are to do this year, I do not know." The then coal crisis was due, not to strikes or *force majeure*, but to commercial and trade conditions resulting from general industrial prosperity—which, it is to be hoped, may be oft-recurring.

In the face, therefore, of merely sentimental and imaginary objections, it may be reasonably held that the ease and cheapness of enrichment by carburetted water gas, as specifically stated herein, remains established.

Next, as to the value of enrichment—quoting from Sir George Livesey's paper: "No one can seriously argue that the slightly higher calorific value of enriched gas, even if the enrichment reaches the consumers, is desirable for heating, cooking, power, and trade or manufacturing purposes. A lower price, rather than the higher quality, is what consumers want; and as to incandescent lighting, experiments made in Germany (and corroborated in England) have proved that, with the Welsbach burner, the light actually increases as the illuminating power of the gas diminishes. To illustrate this point, diagrams showing the result of the German and English experiments have been prepared—for to a fact of such great importance special prominence must be given."

From this text, inspired by the "Dessau Diagram" and similar experimental follies (*ante*, pp. 221-22), was developed the parliamentary evidence that secured the Acts of 1900 and 1902, reducing the illuminating standard of the South Metropolitan and Commercial Gas Companies from 16 to 14 candle power.

The foregoing pages have demonstrated—what must be self-evident to any impartial mind—that the quality of gas is neither immaterial, nor yet a positive disadvantage; but, on the contrary, that the above statement is based on violation of the first principles of combustion, and is diametrically opposed to fact.

Again, with reference to flat-flame burners: "Consumers have it in their power, even with ordinary burners, to increase or diminish the light obtained from the gas to a far greater extent than the difference produced by enrichment. In illustration of this point, the burners (flat-flame) of fifty consumers taken indiscriminately, who lately complained of a bad light, were tested. The illuminating power yielded by these burners ranged from 6 to 17 candles. The gas used was of 16-candle power, burnt on the best conditions as to pressure and quantity for obtaining the most light—more than the consumers would obtain, because they would not burn under those conditions. Of the 50 burners, the highest result per foot of gas, calculated to 5 feet per hour, was 16·9 candles, and the lowest was 6 candles. There were three over 16 candles, two under 7 candles, and 15 (or 30 per cent.) under 10 candles. These complaints, as is the case with all others, were remedied, not by increasing the illuminating power of the gas, but either by changing the burners or improving the supply of gas."

Here we have Sir George Livesey's evidence that 16-candle gas, under proper governing, will give 16 candles in a suitable flat-flame burner, against his later parliamentary evidence (June 30, 1903): "The consumers had used bad burners which gave on the average 9 candles."

Instead, however, of encouraging his consumers to use burners which would increase their average light (for the same consumption) from 9 candles to 16 candles, he advocates a poorer quality because, even with 16-candle gas, consumers with "bad burners" get a poor light! To sustain his case, he undertakes to supply all his consumers, without charge, with governor burners especially constructed to give the maximum light with 14-candle gas. It transpires, however, that this new burner gives about 11½ candles with 5 cubic feet of 14-candle gas, whereas the similar burner for 16-candle gas gives about 16 candles (*ante*, p. 221).

It is evident that the illogical attempt to disparage 16-candle gas, on the ground that this perfect new burner gives a better light with gas of 14-candle power than "bad burners" give with nominal 16-candle gas, in no way qualifies the author's previous conclusions.

We may now pass to the final phase of the current case for low-grade gas—namely, the evidence of the South Metropolitan Gas Company that, since their adoption of the 14-candle power standard, no more gas has been consumed than would be accounted for by normal increases. This is cited by advocates of low-grade gas as conclusive proof that 14-candle gas is as good for the consumer as gas of 16-candle power. The South Metropolitan circumstances do not warrant such a conclusion.

First and foremost, the South Metropolitan Company employed vapour enrichment when under the 16-candle power standard, and admittedly did not supply 16-candle gas to their consumers. We have the specific statement of the Chairman of the Company, corroborated by the parliamentary evidence of the Chief Chemist and Superintending Gas Examiner of the London County Council (*ante*, p. 219) that the gas delivered to the consumer, with and without enrichment, was of practically the same candle power. Their Chairman stated in parliamentary evidence (May 3, 1900): He had never understood that they were to supply 16-candle gas to every consumer, but that it was to be 16-candle power as sent out from the works, and that gas of 16-candle power was to be found at the testing-stations. "My opinion is that if Parliament had intended 16-candle gas to be given everywhere, it would have required us to supply 17 candles." No one denies that the Company have lived up to this limited sense of their obligations, and that their works and official tests have satisfied the legal standard. But, inasmuch as their method of vapour enrichment was worthless, the fact remains that practically the same gas reached the consumer before and after the abolition of their so-called enrichment. Hence, there is no reason why an abnormal increase in consumption should have followed the abolition of such enrichment.

Secondly, coincident with the Company's adoption of the 14-candle power standard, their consumers were supplied gratis with special governor burners giving about 11½ candles with 14-candle power gas in place of "bad burners which gave on the average 9 candles." Also, the energetic policy of the Company in extending incandescent gas lighting effected substantial saving in the consumption of gas. To quote the Chairman at the last half-yearly meeting of the South Metropolitan Company: "What the Company have done has been to supply, under their Act, new and improved burners—the best burner that could be obtained, or could be made, for burning ordinary gas on the flat-flame system. We have supplied these by hundreds of thousands to our consumers, in exchange for burners that did not, many of them, give much more than half the light that is now obtained from these improved burners with a lower quality of gas. Then there is another great improvement in the consumption of gas by means of the Welsbach incandescent mantle. We have now a very large staff of men—between 60 and 70—engaged at the present moment in doing nothing but visit the consumers and attend to their incandescent mantles. Well, the result of the recent introduction of the improved flat-flame burners, whereby the illumination is nearly doubled compared with that obtained from the old and unsuitable burners, and of the incandescent mantle, whereby the light is increased about sixfold, is that the consumers burn less gas."

It is needless to mention other argumentative questions involved in a general comparison of this character. Enough has been said to show that the comparative outputs of the South Metropolitan Company, during and after their attempted enrichment have no bearing upon the comparative values of 16 and 14 candle gas. On the other hand, it is seen above that low-grade zealots "blow hot and cold with the same breath." They obtain relief from a useless method of enrichment, because it does not reach the consumer, and they accompany its abolition with the most comprehensive and enlightened means of saving gas. Then, because an abnormal increase in gas consumption does not follow the abolition of this nominal enrichment, they declare 14-candle gas is conclusively proved as good as gas of 16-candle power, and all "theory" must consequently be flung to the winds.

In the Crystal Palace Company's recent attempt to reduce their illuminating standard from 15 to 13 candle power, their Chairman testified (June 30, 1903): "The Company proposed to give the consumers the whole of the saving. They found that the enrichment cost them ½d. a candle; and that being so, if they reduced the selling price 1d., they would give the consumer all the saving."

Here is a Bill, promoted ostensibly in the sole interest of the consumers, that proposed to compensate them 1d. per 1000 cubic feet (or 3½ per cent.) for a reduction in standard quality of 2 candles (being 13⅓ per cent. by photometric standards, and *over 25 per cent. in flat-flame burners*), notwithstanding the Company's testimony "that 36·6 per cent. of the gas supplied by the Company was used for heating, cooking, engines, and incandescent lighting; the remainder [63·4 per cent.] being used in flat-flame burners"!

The author thinks he may now end his "cross-examination," without qualification in the conclusions he has previously established herein.

With such a case for enrichment, it is scarcely necessary to refer to the foolish attempts *to dilute coal gas* by the admixture of blue (or lightly-carburetted) water gas, although the author has been to some trouble to ascertain what the present advocates of this plan have to say in its favour. Their policy appears to have no other foundation than the superstition that "consumers care nothing for quality, what they want is 'cheap' gas," sometimes supplemented by the erroneous assumption that greater economy attaches to the manufacture of blue water gas in the Dellwik generator than in the Lowe process. This idea of "cheap gas" has been already referred to under "Question of Quality," and for a detailed exposition of this issue the author would refer to his letters on "Flame-Luminosity and 'Cheap' Gas," and on "Blue Water Gas," in the "JOURNAL OF GAS LIGHTING," for March, April, and May, 1902, and February, March, April, and May, 1903.

Finally, *with reference to American conditions:* With similar gases, the advantage of enrichment is greater in America than in London, because (*a*) The average cost of enrichment is somewhat less in America—say, 1c. for the 2 candles, against 0·66d. in London; and (*b*) The average selling price of gas, in common with most commodities, is considerably higher in America—being $1·035 per 1000 cubic feet, by the Census of 1900, against 75c. in London. Hence, *in America*, the London situation would average as follows (see p. 222):—

RESULT OF REDUCTION FROM 16 TO 14 CANDLE POWER.

Average Loss in Useful Effect.		Value of Loss per 1000 Cu. Ft.		Saving in Cost.		Net Loss per 1000 Cu. Ft.
13·1 per cent.	..	13·5 cents.	..	1 cent.	..	12·5 cents.

PACIFIC COAST GAS ASSOCIATION.

Annual Meeting at San Francisco.

(*Concluded from page* 157.)

LIQUID AIR.

Professor G. A. Bobrick read a paper on the above subject, the principal features of which were given in the "JOURNAL" for Sept. 8, p. 621.

Mr. Lowe, in opening the discussion, claimed for the Association the honour of being the first to call the attention of gas engineers to the advantages of liquid air in connection with illuminating gas. He enlarged on the structural advantages of being able to weld with the aid of the Bobrick apparatus—instead of rivet. Wrought-iron pipe, for example, could be joined up absolutely tight. The Secretary understood that two sets of pipe would be necessary. Mr. Britton said that in operating two lines of main, one for six parts of oxygen, the other for eight parts of gas, what should be the pressure in each pipe?

Professor Bobrick said he had mixed the gases and carried them through 2000 feet of pipe to the burner; but the time was not ripe for doing this on the large scale. At present, it was certainly necessary to use two sets of pipes. The gases, once mixed, would not stratify. If the gas was under 4 inches pressure of water, the oxygen might bear 5 lbs. per square inch; the exact pressure was not material. It could be worked at any practicable pressure.

CUSTOMERS AND COMPLAINTS.

Mr. D. Decker, of Santa Rosa (Cal.), read a paper enlarging on the qualifications necessary for dealing successfully with complaining customers. The public judgment of gas companies was based on the manner in which the consumers were treated. Courtesy was a cheap investment that led to big dividends; and failure to keep a promise, or neglect of a request, shook the faith of the public. Confidence once lost was not easily restored.

THE "WRINKLE DEPARTMENT."

Mr. G. S. Colquhoun, the Editor of the "Wrinkle Department," presented a report. The mixture of lamp black with heavy oil and tar, that resulted as a bye-product from crude oil water-gas manufacture could be used as a fuel; but the ordinary grate bars were unsuitable. Round wrought bars, supported on a corrugated cast bearing at each end, and by a flat bearing in the centre, should be used. In connecting meters for measuring the flow of oil, it was necessary to see that the temperature was even, and to avoid all accumulations of gas. A simple inexpensive pressure gauge could be made of two pieces of tube, each having a tee blown on the bottom end, and the two branches joined up with rubber tube. The best way to clean gauge-tubes was by means of a plug of waste tied on a string and moistened with benzene or caustic soda. For guiding the lids of 20 feet square purifiers into place when lowering—an operation which formerly occupied eight or ten men—three clip pieces on each side, having a batter outwards were used, with the result that the cover slid easily into place without help.

THE "EXPERIENCE DEPARTMENT."

Mr. R. P. Valentine, the Editor of this department, complained of lack of support; but he took comfort from the fact that the members were too busy to attend to him. He had an interesting communication from Mr. L. B. Miller, the Advertising Manager of the Denver Gas and Electric Company—dealing with the importance of advertising, and offering some suggestions.

THE "QUESTION BOX."

The Secretary alluded to the work done by Mr. Henry L. Doherty, as Editor of the "Question Box" Department in the Ohio Gaslight Association, which showed the value of such a department. This had led him to believe that a similar plan might be made one of their most important features. Its success or otherwise depended on the interest and support accorded by the members. He had invited inquiry from members of the Association, and received in response some 15 questions. He divided them into two classes, those that could be answered definitely, and those in which the answer was largely a matter of opinion.

The first question considered was the basis on which the executive expenses should be proportioned in a combined gas and electric undertaking. Mr. Britton thought it should be in proportion to the gross receipts. Mr. Philo Jones remarked that the expenses were not always in proportion. He was engaged in an undertaking that supplied water, gas, and electricity. They found it cost more per consumer to operate the water department than the others; and therefore they charged half the executive expenses to that department. The next question was the basis on which to calculate the advisability of supplying an outlying district with gas or electricity. Mr. Britton thought no extension could be considered profitable unless the entire first cost was repaid in two years; and therefore he suggested that the gross annual revenue should be 60 per cent. of the first cost. In many cases the absence or smallness of dividends was due to undertaking such business without due regard to the prospects of its proving remunerative. Mr. Aldrich thought that if this rule was generally accepted, many of them would not extend at all. Mr. Martin said that, in undertaking additional business, some regard must be had to the possibility of future developments. Mr. Keyes said that in supplying natural gas, which cost nothing to make, he found it profitable to lay mains for a gross revenue of only 12 per cent. Speaking on the cost of maintaining Welsbach lights, Mr. Ross said he charged 5d. per burner per month for less than ten, and larger numbers at a lower rate. He sent round once a week, and found that he covered all costs. Mr. Osborn sold mantles at gross list price. He charged nothing for labour, as the profit on the mantles was sufficient for that.

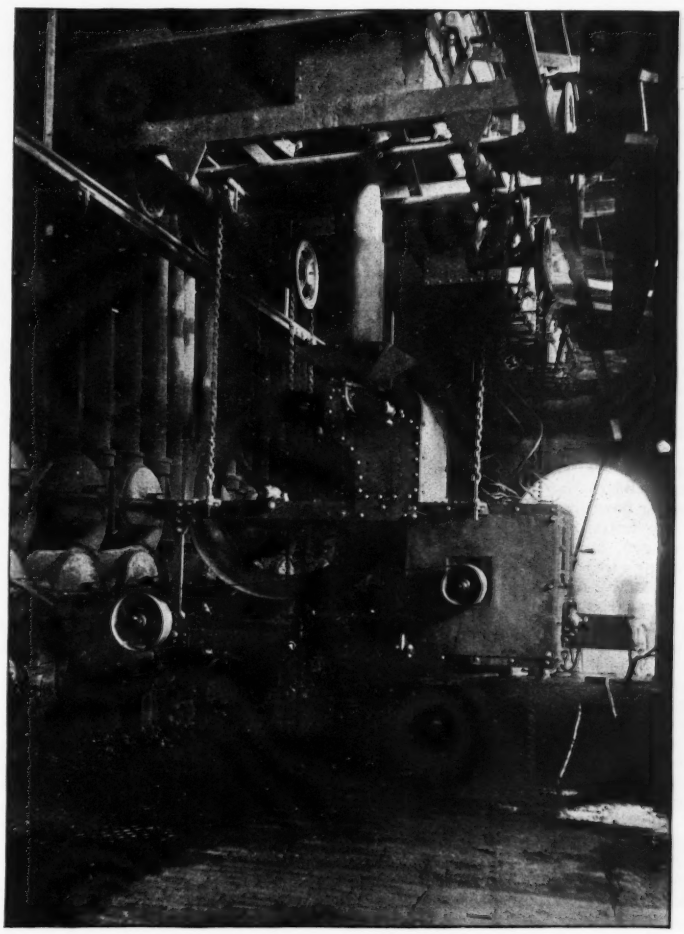
The London and Southern Junior Gas Association will hold the opening meeting of this session at the Regent Street Polytechnic next Friday. The President (Mr. Walter Grafton) is to deliver a short address; and this will be followed by a discussion of the paper on "The Future of the Gas Industry," which Mr. W. Upton read before the Association last May.

Manchester District Institution of Gas Engineers.—We learn from the Hon. Secretary (Mr. H. Kendrick, of Stretford), that the next meeting of the Institution will be held at Halifax, on the 28th prox. The Committee are arranging for a visit to the Halifax Gas-Works in the morning; and in the afternoon there will be provided a varied programme of papers on good discussable subjects.

Yorkshire Junior Gas Association.—In the "JOURNAL" for the 2nd of June last, we announced the formation of the above-named Association, with Mr. Fred Scholefield (of Dewsbury) as the Hon. Secretary *pro tem.*, and mentioned that the session would commence with a meeting to be held in Leeds on the 31st inst. We learn from Mr. Scholefield that the date stands good, and that the members will assemble at the Yorkshire College. A business meeting will take place at 2.30 p.m. for the election of officers for the ensuing year; and immediately afterwards the session will be opened by Professor Smithells, F.R.S., with a lecture on "The Bunsen Burner." At its close, the inaugural dinner will be held in the Grand Restaurant.

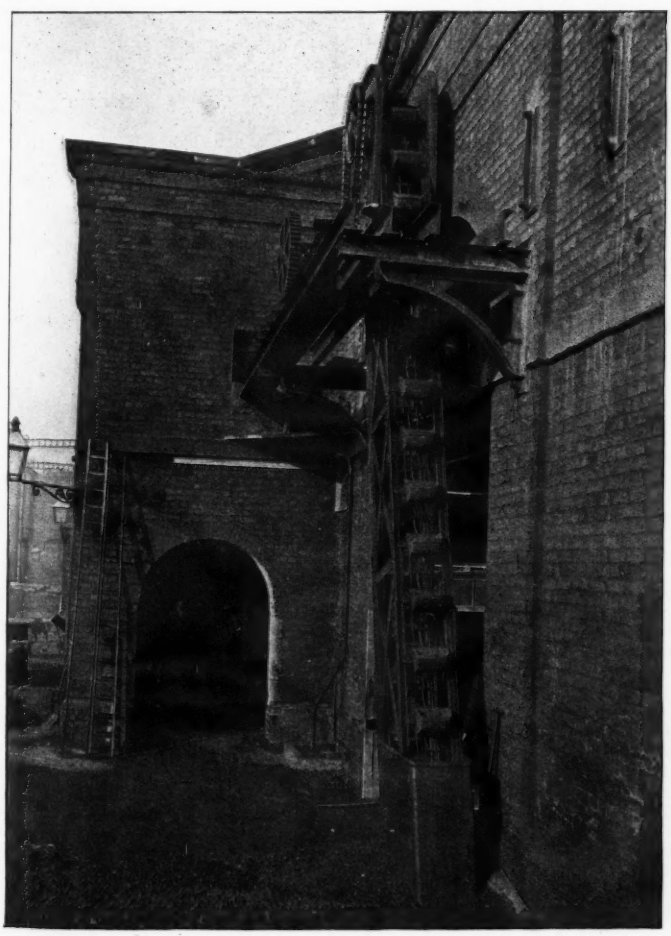
Coal in South-East England.—The Royal Commission on Coal Supplies met again on Thursday at St. Stephen's House, Westminster—Lord Allerton presiding. Professor W. Boyd Dawkins, F.R.S., gave evidence as to the existence of workable coal in the south-east of England. He dealt with the report of the Coal Commission of 1866-7, and referred to the various borings which have taken place since that date, including those of Netherfield, Dover, Ropersole, Ellinge, Brabourne, and the London area. He also discussed the possibilities of finding coal in these districts by the light of the most recent discoveries in France and Belgium. The conclusions he arrived at were these: That in the south-east of England there is a coalfield, or series of coalfields, ranging from Dover north-westward, but that it was impossible for him to define the range, or to give any idea of its commercial value, though such coal as existed would probably prove to be within workable depths. He strongly advocated the making of further borings, as this was the only method by which the existence or value of the coalfield could be definitely ascertained. Finally, he said he regarded the finding and exploiting of the buried coalfield as a matter of great national importance.

THE DE BROUWER PROJECTOR AT DERBY.



Whatever honour attaches to the first adoption of a new invention is enjoyed in this country by the Derby Gaslight Company and their Engineer (Mr. J. Ferguson Bell) in connection with the De Brouwer coal-projector. Notice was taken of the starting of the machine in last week's issue; but then we were unable, owing chiefly to the bad state of the weather for photographic work at the close of the preceding week, to give an illustration of the machine. This, however, we are able to do to-day. The photograph comes appropriately in this number, as it will enable comparison to be made between the machine in its original form—suspended on overhead rails, and with overhead feeding arrangements—and the one shown last Thursday to the Midland Association of Gas Managers at Walsall; the projector in this latter case being fitted in a carriage and frame running on rails in the floor of the house, and carrying a 5-ton coal-hopper and the mechanism for propelling the machine from retort to retort. Mr. Bell prefers the original form on account of its lightness and simplicity, and with a continuous hopper and measuring-chambers; other engineers favour the form seen at Walsall, with the machine hopper fed from a centralized one; while others again have a fancy for the projector on a carriage with a measuring-chamber at the top obtaining coal from a continuous hopper. Of course, the choice is to some extent controlled by the length of the house with which the projector has to deal, and which length dominates the cost of the auxiliary coal plant.

As will be seen by the photograph of the Derby machine, it is similar in form to the one which was first used by the inventor at Bruges, and which we had the pleasure of introducing to the notice of British gas engineers. Of course, certain improvements have been made since. The Derby projector is propelled along the overhead rails similar to an inclined retort shoot; and receives its supply of coal from eighteen measuring-chambers, so that the coal is projected direct into the retort on the pulling of the levers that release the coal from the measuring-chambers. The motor on the machine is of three-horse power; and it takes from 20 to 22 ampères × 110 to 115 V. to work the machine when charging. Of course, it must be remembered that the men are new to the work; but last week they were charging at the rate of 18 through retorts in sixteen minutes, including the moving of the machine, &c. The time of actual charging was only from 20 to 24 seconds.



Regarding the two views, the first shows the projector, and the second the coal-elevator outside one end of the retort-house. The photograph of the projector presents the driving-gear very clearly, as well as the switch and regulator at the back of the machine, which is in position to charge the middle row of retorts. The overhead measuring-chambers and the levers are also distinctly seen. The rails on which the charger travels are suspended by hangers carried from rolled steel channels (9 in. by 3 in.), which cross the retort-house. One end of the channels rests upon long 8 in. by 6 in. joists, supported by the joists crossing the bench; and the opposite ends of the channels are built into the side wall of the house. These few supplementary notes on the Derby installation will, we are sure, be of interest.

Testing Coal Tar and Oils.—Writing in the "Journal of the American Chemical Society," Mr. H. W. Jayne recommends for the above-named purpose the use of a beaker-shaped copper experimental still, with a heavy rim round the top, to which a brass lid is clamped. The condenser consists of a glass tube immersed in an open copper trough, which can be heated when necessary. The tar is heated by a ring burner, which surrounds the still and is adjusted so that the flame strikes about the top of the contents. This is said to prevent foaming. If the contents of it continue to boil over, the author prefers, when making water determinations, to dilute the tar with a liquid having a boiling-point slightly higher than that of water—for example, toluene.

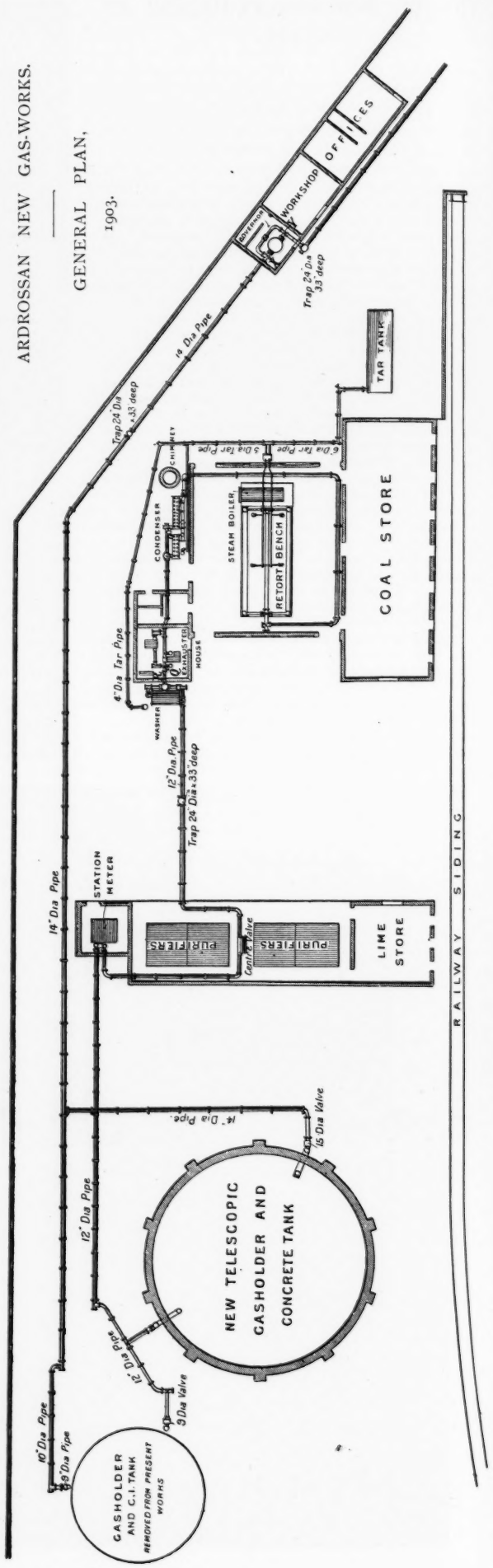
NEW GAS-WORKS FOR ARDROSSAN.

New gas-works which have been erected to plans prepared by Mr. A. Gillespie, of Glasgow, for the Corporation of Ardrossan were opened on Thursday last. From its geographical position, Ardrossan is the key to the Firth of Clyde, whether for military or commercial purposes. This fact has been slow to be borne in upon the minds of commercial men; but that it is now fully, realized, is to be seen in the amplitude of the railway and shipping facilities which are now provided at the Ayrshire port. Neglected for many years, the inhabitants had the mortification of seeing other communities outstripping them; but at last capital was diverted in their direction, and they rose to the occasion.

Leaving out of account what has been done in other directions, it has to be noted that one of the first things which the Corporation set about was getting into their own hands the gas and water undertakings. In 1886, an Act of Parliament was passed which authorized the transfer. Arbitration proceedings followed in January, 1887; and the transfer took place in May of that year. The price paid was £24,000 for both undertakings, of which about £4000 was the cost of the Act and the proceedings under it. The gas-works were old, and occupied a site where enlargement was impossible. The only way out of a difficulty which was growing greater year by year was to erect new works. This step, in view of the initial outlay, was deferred as long as possible, and the Manager (Mr. W. Galbraith) has had many an anxious time in keeping up the gas supply—more particularly in recent years. It became apparent, however, that a move must be made; and the Corporation, after a good deal of cogitation over the subject, and inspection of sites, purchased 4 acres of land lying alongside the large branch of the Glasgow and South-Western Railway, but within the burgh boundaries, upon which to erect gas-works and a refuse destructor. Everything in connection with both works has been done upon the advice of Mr. Gillespie, who has been Consulting Engineer to the Corporation for the past twenty years. A railway siding was first constructed, which runs the whole length of the site. On the other side, a roadway has been made all along the ground; and between the roadway and the siding the works are situated—the refuse destructor occupying the north end.

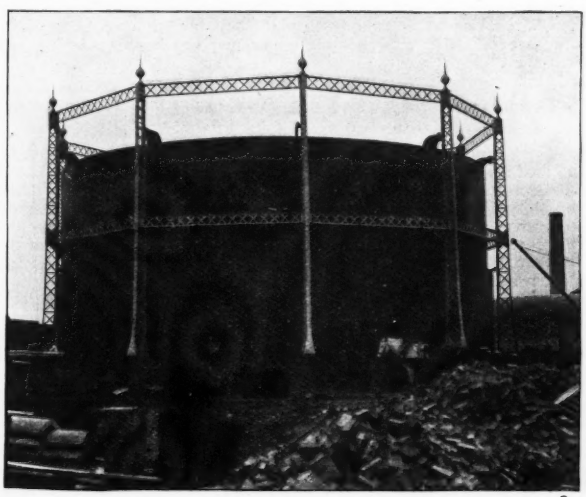
Entering from the south end, the first building encountered is a range which includes the general office, manager's room, workshop, and governor-house. Then there is a broad yard, in the centre of which is the tar and liquor well. Further on, running north and south, is the retort-house and coal-store, under a double-bay roof. The retort-bench is a double one, containing eight ovens. Five of these have been filled with five retorts each, leaving three in reserve. The firing is by a shallow regenerative system of Mr. Gillespie's own design. At one end of the bench is a steam-boiler; and at the other end the bench and the house can be extended to double the present size. At each side of the retort-house is an erection resembling an old-fashioned hanging chimney, within which the coke is quenched. Entering from the retort-house is a commodious workmen's room, with bath-room adjoining, so that from beginning to end of a shift the men do not require to leave the shelter of the house. The coal-store alongside is capable of holding more than it is likely will ever require to be kept in it; and, as a matter of fact, about one-third of it is used for the dry storage of coke. The coal is shot into the house from the railway waggons through iron shoots, which are hinged so that, when not in use, they fold up and form doors for the apertures. The tar and liquor are drawn off from the hydraulic main together. The foul main traverses three sides of the retort-house, and then, passing through the wall, communicates with a set of condensers which have been built in two sections, one larger than the other, and so constructed that either one or both may be worked at one time. An exhauster, capable of passing 20,000 cubic feet of gas per hour, driven by a steam-engine, is located in a building contiguous to the retort-house. In the same building is another small steam-engine, which, by a shaft through the wall, drives a Holmes scrubber-washer in the open air. Across another yard is the purifier-house, open on one side. Two boxes have been erected, in each of which there are two purifiers, each 15 feet square by 5 feet deep. Lime only is used. At the end of the purifier-house is the meter-house, in which there is a station meter of 20,000 cubic feet per hour capacity. Behind the purifier-house there is space for another house; and then there has been built a gasholder with a concrete tank 84 feet in diameter by 21 feet deep. The holder is a telescopic one, of a capacity of 200,000 cubic feet, and is guided by ten steel lattice standards. There is room left for another holder; and this will shortly be occupied by the existing holder removed from the old works.

The excavation of the gasholder tank, and the whole of the brickwork of the buildings and retort-bench, were the work of Mr. C. M. Hamilton, of Hamilton. The roofing was contracted for by Messrs. Miller and Sommerville, of the Tradeston Iron-Works, Glasgow. The holder was built by Messrs. Clayton, Son, and Co. The station governor was provided by Messrs. Parkinson and W. & B. Cowan, the station meter by Messrs. James Milne and Son, the purifiers by Messrs. Newton, Chambers, and Co., the steam-engines by Messrs. Bryan Donkin and Clench, the washer-scrubber by Messrs. W. C. Holmes and Co., the steam-boiler by Messrs. Thomas Hudson, Limited, of Coatbridge, the condenser



A General View in the New Works—Engine-Room, Retort-House, Washer, Condensers, &c.

by Messrs. Pearson and Ramage, of Alloa, and the retort-bench ironwork by Messrs. Henry Balfour and Co. Work was begun in the first week of last November; and gas was made on the 2nd inst. The cost has been about £15,000. The total annual make of gas is something like 24 million cubic feet; and it is growing steadily. The maximum daily make is about 100,000 cubic feet. Provision has been made in the new works for an output of 300,000 cubic feet of gas per day; and, as stated above, there is ample room for the doubling of all the plant. The new site is at the higher end of the town, and in consequence a night pressure of 17-10ths is necessary.



The New Holder—A Neat and Light Framing.

A small company having assembled in the governor-house, Provost Young said it was with feelings of considerable interest and pleasure that he was there that day—feelings of interest because for a considerable time he had realized the necessity of their going in for new gas-works. He had done all he could to promote the scheme; and it was now a pleasure to him that it had become an accomplished fact. They had now a gas-works which would compare with any in the West of Scotland. Great credit for this was due to Mr. Gillespie. They could not at such a time overlook the services of Mr. G. Kinnaird, who was Mr. Gillespie's Assistant and Clerk of Works during the whole time of the erection of them, and who, as they would see from the quality of work around them, had proved himself to be a most capable man. He had now the honour and the pleasure of turning on the gas from the new works to the town. He congratulated he Manager upon the new works which he now had charge of, and expressed his confident belief that he would be able to give them a plentiful supply of gas of high illuminating power. The company then drove to the old gas-works, where, the gate having been shut, Provost Young locked it, and declared that they were now closed.

Thereafter the party sat down to luncheon in the Eglinton Arms Hotel—Mr. Gillespie in the chair. Provost Young proposed the toast of "Success to the New Gas-Works." When he first knew the Ardrossan Gas-Works, thirty years ago, he said, they were making from 4 to 5 million cubic feet a year. They could all see that there had been a great development since then. He coupled the toast with the name of Mr. Gillespie, who had done such excellent work for them during the last twenty years. Mr. Gillespie acknowledged the toast, and related a number of his earlier experiences in connection with gas supply. With regard to the new works, he had to say that the way in which the Contractors had done their work was manifest to them all. He referred particularly to the gasholder, which had not a buckle in it. Mr. Gillespie then proposed the health of Provost Young, expressing the pleasure it had always been to him to be connected with the Town Council. In token of this, and in order to mark an auspicious day for the town, he presented Provost Young with a copy of Mr. John Morley's "Life of Gladstone," with an inscription to the effect that it was presented by Mr. Gillespie on the occasion of the opening of the new gas-works. Provost Young expressed his thanks for the gift, which he said he would highly prize. The health of Mr. G. Kinnaird was proposed by Provost Young; and that of Mr. J. R. Smith, the Convener of the Gas Committee, by Bailie Guthrie. Mr. Smith briefly acknowledged the toast.

Manchester and District Junior Gas Association.—We learn from the Hon. Secretary of this Association (Mr. F. Oldfield) that the fifth annual general meeting will be held in the Municipal School of Technology, Manchester, next Saturday, when the Council will present the report and balance-sheet, the officers for the ensuing year will be elected, and the President will deliver his address.

Dibdin on Water and Sewage Purification.—We have received from the Sanitary Publishing Company, Limited, the third edition of Mr. W. J. Dibdin's well-known work on "The Purification of Sewage and Water." The original book has been considerably enlarged, and as now presented it deals with the results of the latest investigations by the author and others. The text is accompanied by a number of tables, diagrams, and illustrations.

Slow Combustion of Methane and Ethane.—A paper on this subject was read by Dr. W. A. Bone before the Chemical Section of the British Association. The author has been studying, in conjunction with Messrs. R. V. Wheeler and W. E. Stockings, the slow combustion of ethane and methane at temperatures below their ignition points. He remarked that engineers believe in a preferential combustion of hydrogen; in other words, that, with a defective supply of oxygen, the hydrogen would be burnt in preference to the carbon of a hydrocarbon. In his opinion, there is no evidence to support this view. Preferential combustion of carbon was first suggested by Kersten in 1861, chiefly because the explosion of ethylene with an insufficient amount of oxygen yielded carbon monoxide and free hydrogen. Preferential combustions, however, were not in accord with modern conceptions. These conclusions had been based on reactions occurring at high temperatures, in flames or in explosive waves; but under these conditions it was impossible to distinguish between the primary and the secondary reactions, as equilibrium was established almost instantaneously. The author described some experiments of his own in support of his views. The paper was followed by a discussion on the general subject of combustion.

THE "ECONOMY" GAS COOKING-STOVES.

In our issue for September 1 last, there appeared in the "Register of Patents" a short description of a new burner, and method of applying it, for cooking and heating; the patent being the property of the Hildesheimer Sparherd-Fabrik (A. Senking). The invention as embodied in stoves, hot-plates, &c., is now to be seen at the offices of Mr. L. Rasch, of 121, Victoria Street, S.W. The great feature is that the burners are closed in, and are not exposed as is usual; and it follows that the process of heating is indirect rather than direct. For example, instead of the ordinary open bars at the top of a stove, the ring-burners are completely covered in.

The benefits which are said to accrue from this method are a saving of gas, an entire absence of fumes, great cleanliness, and durability. With the burners enclosed, the hot-plate becomes a heating surface all over, and so all the top can be used for cooking; one burner, the information is given, being equal to the heating of a surface capable of containing from four to six vessels. The burners themselves are constructed in three parts, detachable by hand for cleaning purposes. To the larger duty obtained from one burner in this way is attributed a considerable saving of gas. A flue-pipe carries away the fumes from the chamber formed by this enclosed system of construction. All stoves are built of wrought iron, with special malleable cast-iron top-plates; the body is japanned or enamelled outside and tinned inside; and the railing and taps are nickel-plated. They present a strong and durable appearance. The price, like the consumption, is placed at a moderate figure.

Mr. Rasch has patented a combined gas-cooker and hot-water circulating boiler; and we do not remember to have seen anything similar to this on the market. The range comprises the oven, hot-plate (as previously described), griller, and a double boiler in a chamber at the side of the oven. The flues are arranged in such a manner that the waste heat can be retained for warming the kitchen, or immediately passed away to assist in keeping the temperature low. The apparatus is built in a very substantial manner; and the double boiler is made of stout sheet copper, fitted with bolted manholes for cleaning purposes, and with large and small burner, and pilot-light underneath. By this combination, a complete hot-water circulating system can be installed in any house, giving, as the inventor puts it, "all the advantages of coal ranges, without their disadvantages." The average expense of the hot-water system is computed at ½d. per hour during use; and it enables hot water to be obtained throughout a house in fifteen minutes.

Oil Output of America Last Year.—In his report to the United States Geological Survey on the production of crude petroleum last year, Mr. F. H. Oliphant gives a table showing approximately the output in all the known countries of the world, with the percentages of each in barrels of 42 United States gallons. Out of the total of 177,231,900 barrels, the United States had 80,894,590 barrels, or 45·64 per cent., and Russia 80,540,045 barrels, or 45·44 per cent. Roumania produced only 2,059,930 barrels, or 1·16 per cent., while Galicia's output was 4,142,160 barrels, or 2·35 per cent. Compared with the year 1901, Russia's production decreased, while that of the United States increased.

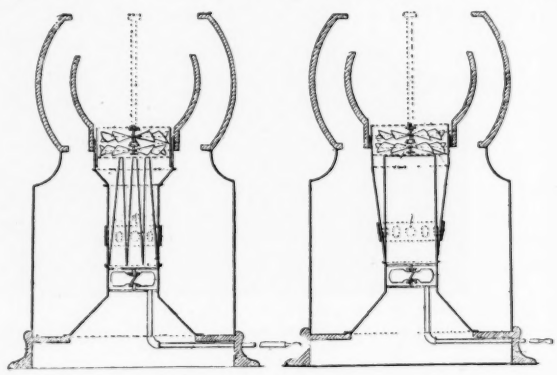
Public Lighting with the "Millennium" Burner.—Particulars have been published of a trial of these burners, to which reference was made by Professor Lewes in one of his last series of Cantor Lectures at the Society of Arts, for lighting a portion of the Alexander Platz in Berlin. Twenty lanterns were placed on stands 18 feet high; fifteen being fitted with two burners, and the rest with a single burner in each. The total illuminating power was equal to 1500 candles. Photometric measurements showed that the light was much more powerful and uniform than that given by electric arc lamps; and after an experiment lasting more than six months, it was decided to extend the lighting by this system. Works were erected to supply compressed gas for the Platz, part of the Königstrasse, and the road to the Spittel Markt, as well as for certain private consumers. The best pressure for working was found to be 54 inches of water.

Straightening a Leaning Chimney.—We learn from the "Engineering Record" that a leaning chimney has been straightened by a simple method devised by Mr. Joseph H. Gerhard, of Providence (R.I.). The stack is 8 feet in diameter inside and 192 feet high. A short time after completion, it began to lean to the east, until the movement reached 4 feet and was apparently still continuing. To straighten it, a course of brick on the west side of the stack was removed for a depth of three-fourths of the thickness of the shell, and the space filled with oak wedges. On the east side a thick (10 ft. by 20 ft.) bed of concrete was laid against the foundation. Two holes were then cut through the shell on the east side, and heavy steel beams were passed through them. Screw-jacks were placed between the concrete and the beams, and with their aid the stack was slowly brought back to a vertical position; the wedges being burned out by a gas-flame driven against them with an air-blast. When the straightening was finished, the holes were filled with concrete—the steel being left in place.

REGISTER OF PATENTS.

Gas-Lamps for Lighting and Heating.—Imbert, G., of Brussels. No. 18,942; Aug. 28, 1902.

The inventor uses a mixture of air and gas combined "in the requisite theoretical proportions" by means of a mixer consisting of a helical fan having two or more helices turning in opposite directions, and arranged near the combustion-chamber proper, so that "the intimate mixture, when once effected, may be passed into the chamber before any dissociation can take place." The object aimed at is primarily to obtain a perfect mixture. Air and gas being two fluids of different densities, their mixture can only be suitably utilized if it is effected at,



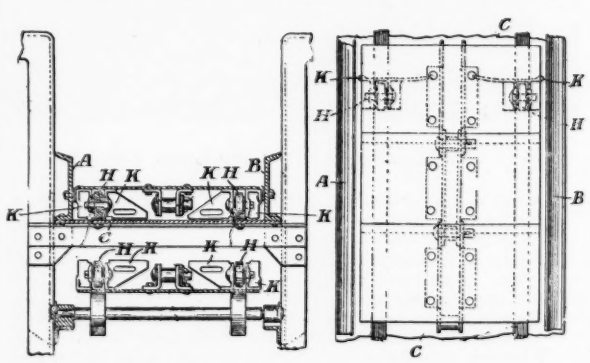
or as near as possible to, the place of combustion. The arrangement shown secures other advantages arising from the employment of helices turning in opposite directions—notably that of preventing the direct passage of the mixture to the burner, properly so called, whereby the flow of the mixture is obtained a sufficient time to allow the mixers to effect the intimate mixture of gas and air throughout the entire body, and so increase the pressure and raise the temperature of the mixture.

The arrangement can be operated by the action of the pressure of the gas and the draught of air, or of a mixture of the two fluids already partially effected in a preliminary mixing-chamber; and it can be combined or not with a new supplementary draught of air and gas. Two different ways of carrying out the invention are shown. The first is a burner constructed so as to be specially suitable for heating purposes; the second is a similar heating apparatus, but having a cylindrical chamber.

Coke-Conveyors—Little, G. & A. J. S. B., of Smethwick. No. 20,984; Sept. 26, 1902.

This invention has reference to hot-coke conveyors of the kind described in patent No. 17,824 of 1898, in which an endless belt or line of plates works along the bottom of a water-tight trough into which the hot coke falls, and along which the coke is carried by the conveyor and delivered at the end of the trough without breaking. The present invention consists of improvements whereby "the efficiency of the conveyor is increased, and the parts are so made that they will last longer in wear and can readily be renewed when required."

The water-tight trough in which the conveyor chain works is formed of two channel section-bars A B, which are arranged with their wider sides vertical, so as to form the two sides of the channel; and to the bottom flanges of these channel-bars plates C are riveted and jointed



end to end, to form the bottom of the trough along which works the chain provided with the coke-carrying plates D. In order to make the conveyor-chain work easily along the bottom of the trough, the coke-carrying plates are at intervals provided underneath with rollers H (of manganese steel), arranged, say, on every third plate. Fixed to the underside of some of the carrying-plates are scrapers K, which, projecting downwardly, almost touch the bottom of the trough. These scrapers are shaped so as to work along the bottom of the trough and scrape out any breeze which gets down from the top to the underside of the carrying-plates. The return part of the chain underneath the bottom of the trough works (as heretofore) on ordinary rollers, carried by any convenient means—as by the frame which supports the trough, or on brackets fixed to the floor-joists or to the buckstaves.

The conveyor-chain which carries the endless belt or line of plates is, by preference, a single endless chain of about 12 inches pitch between the connecting-pins; the links being made of angle section, with their horizontal flanges fixed to the underside of the carrying-plates.

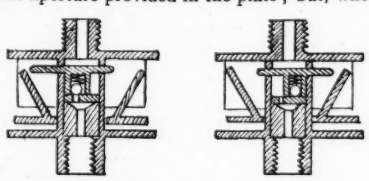
Manufacturing Incandescent Mantles.—Adam, W. W. (Plaissetty Syndicate) and Adam, M. A., of West Hampstead. No. 21,274; Sept. 30, 1902.

This invention relates "principally to the manufacture of incandescent mantles, but also in part to burners and mechanism connected therewith for burning off incandescent mantles, and applicable also for lighting by means of incandescent mantles."

The proposal is to employ for the burning off of incandescent mantle stockings a flame whose character can be changed, as required, from an oxidizing or over-aërated condition to a condition having the state of aëration which produces the maximum temperature. A further part of the invention consists in a construction of burner whereby a mixture of gas and air in nearly true combining proportions, or having an excess of air over that required for complete combustion, may be obtained and burned steadily without firing-back, and employing a regulating device controlling the secondary air supply, whereby the character of the flame may be changed, either at will by hand or at predetermined intervals automatically, or both.

Spherical Valves for Gas-Pipes.—Scherff, H., of Leipzig-Plagwitz, Germany. No. 22,138; Oct. 10, 1902.

This valve for gas-pipes contains a sphere placed within a case, open on one side, which is sliding in a guide, and with which the sphere is led to and fro on a plate which carries the aperture for the passage of the gas. At the same time, the sphere is pressed against this plate by a spring. When the pipe is closed, the valve is pressed down by the spring upon the aperture provided in the plate; but, when the pipe is



opened, the case is placed in such a manner that the sphere uncovers the aperture of the plate, whereby the pipe is opened to the burner. In the present invention, all defects in the operation of the valve are said to be "suppressed," because the sphere of the valve cannot be disturbed either by the dust and other impurities, or by the shocks or inaccurate position of the device.

The reciprocating motion of the valve may be effected mechanically or electrically. In the latter case, two armatures of an electro-magnet operate the valve-box, and cause it to reciprocate from the open to the closed position, by means of a guiding stem. The mechanical opening or closing of the valve would be effected by suitable lever-mechanism.

Carburetting Air for Lighting, Heating, Motive Power, and Other Purposes.—The Fietz (Preliminary) Syndicate, Limited, of Cannon Street, E.C., and Grist, C. J., of Banstead. No. 22,690; Oct. 18, 1902.

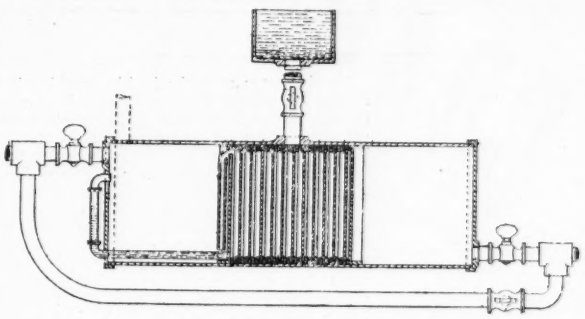
This invention relates to mixtures and apparatus for carburetting air; and its object is principally for the purpose of obtaining a mixture of oil vapour and air so that "a very small percentage of the vapour in the mixture will have the heating power necessary to render a mantle incandescent when it is thrown upon it, and a light applied, without the necessity of heating or warming the air or the vapour or the apparatus employed for the generation of the vapour."

A convenient form of apparatus consists of a receptacle with closed ends, and divided interiorly by two transverse discs or plates into (say) three compartments or chambers. One of the plates is perforated in its upper half with a number of fine pin-holes, through which the air passes under pressure in fine jets or streams from the first to the second chamber, while a pendant pipe connects the second and third chambers together. In the central or second chamber are fixed a number of vertical discs of wick, cloth, or other absorbent material, for raising the hydrocarbon (which is in a pool at the bottom of the chamber) by capillary attraction, and through which discs the air is made to pass on its way to the third chamber. The inlets for the air and liquid, and the exit for the gaseous mixture, are each controlled by a tap or cock.

A suitable liquid oil mixture for use with the carburettor may be prepared in the following manner, and in about the proportions named: A volatile hydrocarbon—such as commercial benzene—from ·715 to ·750 specific gravity, is employed and mixed with turpentine (after distillation) and alcohol of ·797 specific gravity, in about the following proportions: With 85 parts of benzene are mixed 10 parts of turpentine, and 5 parts of alcohol. These proportions may be subject to variation for particular qualities of liquid; but for lighting purposes, "a highly efficient mixture is obtained by adopting these exact proportions." To the mixture are then added about 10 grammes of flowers of sulphur and ¼ gramme of metallic mercury to every 600 cubic centimetres of the mixture. The mixture is then well stirred, or the receptacle containing it shaken, so as to thoroughly mix the contents; and it is then allowed to stand until the liquid is rendered clear by the subsidence of the added sulphur and mercury. The mixture of oil and spirit is then filtered or drawn off, and is ready for use.

The sulphur and mercury can, it is said, be used over again in the treatment of a fresh bulk of liquid, as they do not appear to undergo any chemical change. The effect which they produce upon the liquid under treatment is such as "to heighten considerably the efficiency of the liquid as a source of inflammable gas."

With an oil mixture prepared as described, after being mixed or impregnated with air in the proportions named in a carburettor such as the one illustrated, a gaseous mixture is produced in self-burning

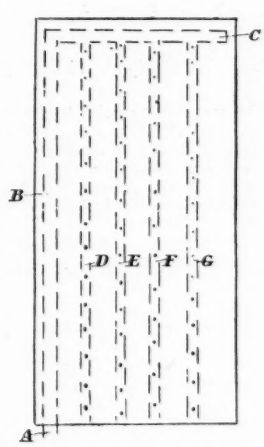


proportions and of practically uniform richness, and used without necessitating the heating of the air either prior to, or during, its passage through the carburettor, or of the vapour, or of the carburettor employed for the generation of the vapour. Further, the oil mixture is easily raised by capillary attraction, and does not readily become solidified by the passage of air over it during the vaporizing process.

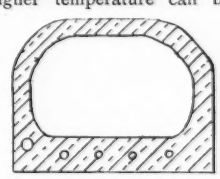
Air travelling through the carburettor as described—on coming in contact with the liquid mixture at a water pressure of (say) ½ inch to 1½ inches for lighting purposes—will, it is said, readily vaporize the mixture, and carry with it a small proportion of the inflammable vapour; and the mixture of the air and vapour, when travelling under pressure, will ignite on the application of a light, and burn—"evolving great heat with very little luminant flame. This heat-flame can be utilized for lighting by rendering a mantle incandescent, or for heating purposes, or for motors."

Manufacture of Water Gas.—Clay, J., of Hebden Bridge. No. 24,371; Nov. 7, 1902.

The patentee proposes to pass steam through the residue of coke left in a coal-gas retort having a tube A C for conveying it to a number of branches D, E, F, G; the latter opening into the retort by small orifices at suitable intervals. The main branch is connected outside the furnace with the boiler. When the steam is turned on, it passes along the pipe A C through the branches D to G out at the orifices, and is thus distributed to, and brought into intimate relationship with, the incandescent carbon in the interior of the retort.



The inventor remarks: By this method, the following (among other) advantages are secured: "A much higher temperature can be em-



ployed—which is precluded by the use of iron or other metal pipes in the retort—as the decomposition of steam into its constituents oxygen and hydrogen takes place more readily above the melting point of metals, together with the further advantage of a less proportion of carbonic acid being formed with the carbonic oxide. The importance of this is obvious. Further, by my method of introducing the steam this is at once brought into intimate contact with the coke; the latter helping to dissociate the molecules of water, and by at once uniting with the oxygen, recombination of the oxygen and hydrogen is prevented.

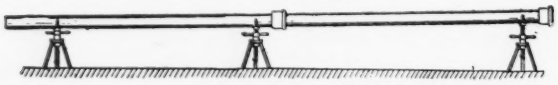
Manufacturing Generator Gas.—Dowson, J. Emerson, of Victoria Street, S.W. No. 25,310; Nov. 18, 1902.

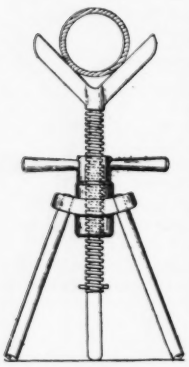
In this invention, air, or steam and air, are made to enter the generator or producer at or near the top and the bottom—there being one or more gas-outlets about half-way up the generator, through which the gases from the upper and lower parts go out. In this way, says the patentee, the fuel in the lower part of the generator is worked by an up-draught, while that in the upper part of the generator is worked by a down-draught. The gases formed in the lower and upper parts of the generator then pass outwards through the outlets.

This way of working a gas-generator is said to be especially suitable where the gas is made from bituminous coal or other fuels containing hydrocarbons, as the portion of the fuel not converted into gas in the upper part of the generator is made into gas as, and when, it reaches the lower part.

The air required for producing gas in the generator may be forced in by a pump or blower, by a jet of steam, or by any other suitable means, or it may be drawn into the generator by suction in any convenient manner. For this purpose, the suction caused by a gas-engine may be used where there is an engine being driven by gas as made in the generator.

Supports for Use when Laying Gas and Water Mains.—Layton, A. E., of Redditch. No. 25,036; Nov. 14, 1902.





The inventor remarks in his specification that at the present time, when mains of comparatively small diameter are being laid—say, up to 10 inches—it is customary to joint several lengths of the pipes on the ground before they are laid in the trench. "While making the joints, the pipes are laid in V-shaped wooden blocks; and in order to make the pipes lineable, the low parts are packed up with stones, clay, yarn, or anything handy (with more or less success), and it often happens that considerable time is wasted in packing up the pipes, and even then they are liable to roll and be displaced. My invention is designed to provide quick and accurate means for raising and holding the pipes lineable while the joints are being made."

He proposes to form specially constructed screw-jacks, which at the top of the screw has V-shaped parts to receive the pipes. Several of these screw-jacks are placed in a straight line—for instance, the illustration shows three of the jacks on inclined ground supporting, level and lineable, two lengths of spigot and socket pipes of which the joints are to be made. The pipes are laid together in the V-shaped parts at the tops of the screws; and then, by means of the screws, the pipes can be quickly raised up or lowered as may be required to bring them lineable, and there they are retained in position while the joints are being made.

The V-shaped pipe-receiver part of the screw-jack is permanently fixed to, or formed with, the top part of the screw, which latter passes easily through the plain central boss part of the jack, which is made with three legs. On the screw above the boss is a nut with which the screw engages—provided with handles by which it can readily be turned, so that the pipe carried by it will be raised or lowered as required.

Purifying Gas.—Schill, C. H., and Lane, H., of Hyde. No. 26,195; Nov. 28, 1902.

This invention has for its object the separation of the tar held in suspension in gas as it leaves the "producer," and the deposition of the tar in such a form that it can be readily removed by the application of a suitable oil—such as a mineral oil of low quality—applied to the gas preferably immediately after it has left the generator and has passed through the cooler. The oil may be used alone or mixed with water or other liquid, and may be applied to the gas (preferably in the form of spray) by an atomizer, or in a scrubber or mechanical agitator or other device or appliance.

A convenient arrangement of apparatus is that described in patent No. 27,917 of 1902, in which the gas to be purified is conducted from the generator into the bottom of a vertical cylinder and takes a zig-zag course upward; the ascending gas being treated by finely comminuted oil, or a mixture of oil and other liquid, descending also in a zig-zag course through the cylinder—the purified gas finally passing away from the cylinder to a holder, or where required.

The effect of treating the gas with an oil spray or vapour is, say the patentees, to separate the tar and cause its deposit in a solid spongy form, in which it can be readily handled and from which the oil can be easily recovered by pressure or other mechanical means.

Controlling the Admission-Valve of Internal Combustion Engines.—Abel, C. D.; a communication from the Gasmotoren Fabrik Deutz, of Köln-Deutz, Germany. No. 26,869; Dec. 5, 1902.

The object aimed at by the patentees is to vary the lift of a gas-engine admission-valve according to the requirements of the engine while the period of opening is kept constant, so that, since the cross section of the opening will be decreased as the load on the engine decreases, the speed with which the gases pass through the valve is increased as the load decreases, and consequently an efficient intermixture of the gases is maintained for varying quantities of charge.

This result is effected by connecting the valve-spindle, either directly or through suitable connecting mechanism, to one end of a lever, the other end of which is pivoted to a rod moved by a cam in the usual way. If the fulcrum about which the lever turns occupied a fixed position with respect to the lever, the lift of the valve would remain constant. The fulcrum is, however, a moveable one, and is connected to the governor so as to travel along the lever (or an attachment of it); and by this means the effective lengths of the two arms of the lever—and consequently the lift of the valve—are altered in a manner corresponding to the variation of the load on the engine.

Incandescent Gas-Burners.—Bray, J. W., of Leeds. No. 5215 March 6, 1903.

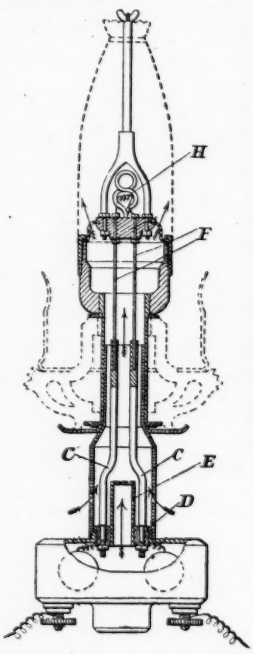
This invention relates to the construction of a steatite or other non-corrosive material burner-tip, "in such a manner that the gas may be consumed more economically, and a better light obtained than has hitherto been the case."

As shown, the steatite tip is made of circular form, having towards its outer edge a circle of rectilineal perforations of "convenient size. Inwards—that is, nearer to the centre, and some little distance from the rectilineal perforations—is another row of rectilineal perforations, also in the form of a circle. The centre of the upper face of the tip is formed into a boss with a hole in the centre for the mantle-rod. The underside of the burner has also a boss formed on it, through which the hole for the mantle-rod is continued. In the walls of this hole are

cut three grooves or keyways, into which are fitted three keys, formed on a brass plate, carrying also three longer arms. When the keys are inserted into the keyways or grooves, the longer arms are turned up round the boss on the underside of the tip. The keys on the plate fitting in the grooves thus form a clip, whereby the mantle-rod is held firmly in the socket. The tip is placed in the upper portion of what may be termed a socket, fitting into or over the top of the burner-casing in connection with which it is to be used. Ordinary wire gauze is fitted underneath the steatite tip.

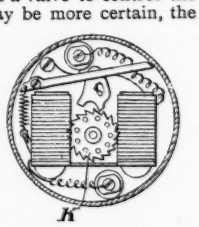
Controlling and Lighting Gas-Burners.—Down, H. L.; a communication from C. Franzen, of Cologne. No. 26,694; Dec. 3, 1902.

In patent No. 635 of 1899 is described an electrical device for controlling the supply of gas to a burner and igniting the gas from a distance, in which the electrical conductors to the igniter extend up the interior of the burner-tube—there being provided a number of conducting parts designed to be readily disconnected.



The present invention reates to an improvement whereby the number of parts is lessened.

The wires which pass round the cores of the electro-magnet are connected with electrically conducting rods C, which extend up the burner-tube, and at their lower ends pass through holes in an insulating annular disc D, surrounding the jet E. At the upper ends of the rods are tubes F of electrically conducting material, which pass at their upper ends through the insulating block G. The platinum wire H, which is to be heated by the current for the purpose of igniting the gas, is surrounded by a cage of stout wire. In order that the action of the ratchet-disc K that acts as a valve to control the gas supply may be more certain, the pawl L,



which is pivoted to the armature of the magnet, has a slot through which projects a pin inserted adjustably in the bottom of the casing. The pawl has two noses, one of which drives the ratchet-wheel when the armature is attracted, while the other acts as a stop to prevent the ratchet from over-running.

When the circuit that includes the platinum wire H is closed—say, by a switch at a distant station—the magnet is energized to attract the armature, and thus to turn the disc K to make its perforations coincide with those in the disc contained in the neck, Passages for the gas are thus opened, and remain so until the circuit is again closed to rotate the disc K, and thus put the perforations out of register.

Pneumatically-Acting Apparatus for Distant Lighting of Gas-Lamps.—Wieser, E., and Schlaich, H., of Colebrooke Row, N. No. 8412; April 14, 1903.

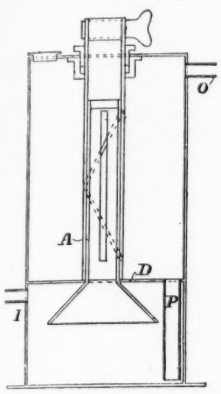
This apparatus consists of a plate with an outlet which has an inside screw, for the purpose of attaching it to the gas-pipe. Around the centre of the bottom plate, holes are drilled to let the gas pass into the burner. These holes will be open or covered by a bevelled toothed-plate which has holes to correspond with the holes of the bottom plate. In connection with the toothed plate is a lever, fixed to a knob, which tightly closes an air-cylinder connected with the outside air-pipes in a suitable manner. The outside air-pipes are preferably leaden, and will end at any given distance in an air-push similar to those in use for pneumatic bells.

The apparatus is set to work by pressing the push, whereby the air in the pipes will be compressed and force the knob of the cylinder in the burner to go forwards; and in this way the lever slides over one tooth of the tooth-plate. On letting the air-push go, the compressed air expands and draws the cylinder-knob back into its first position, whereby the lever which had been brought behind one tooth of the bevelled toothed plate forces the plate to turn, and in this way either

the holes of the toothed plate come in position exactly over the holes of the bottom plate so as to allow the entrance of the gas into the burner, or the parts between the holes of the toothed plate cover the holes of the bottom plate, and so the entrance of gas into the burner is prevented. Through the centre of the bottom plate and burner there is a bye-pass, which lights the gas as it enters the burner.

Saturating Gases with Vapours to Different Degrees of Saturation.—Godden, H. L., of Coleherne Road, S.W. No. 14,939; July 6, 1903.

This is a process for carburetting air or coal gas, whereby the degree of saturation may be regulated by passing the air or gas through the liquid of the vapour in such a manner as to maintain a perfect circulation of the liquid used and a uniform temperature, without the intervention of mechanical moving parts.



The apparatus consists of a vessel divided into two compartments by a diaphragm plate D. A pipe P allows a connection between the bottom of the top part and the bottom of the lower part. A fixed vertical pipe A, terminating at its lower end preferably in an enlarged orifice or cone, allows a connection between the top parts of the two divisions of the vessel; while there is another vertical pipe, fitting well and evenly over A, but moveable either by sliding or turning round on it. The outer pipe projects beyond the top or cover of the vessel, passing through a gland or stuffing-box, where it is closed at the top and fitted with a handle by which to move it round. The pipe A is closed at its top end, and has a vertical slot cut in it; and the outer pipe has a similar slot of equal vertical height, but cut spirally, so as to make one complete, or nearly complete, turn of the pipe. Whatever, therefore, are the relative positions of the two pipes about their axes, these slots will only cross each other at one point; and by turning them, the level of this point of crossing, and the small aperture made thereby, can be raised or lowered at will to any position within the vertical limits of the slots. I and O are the inlet and outlet for the air or gas to be treated.

The apparatus is filled with the liquid to be used to some level above D, as desired. The air or gas to be treated is admitted under pressure, and travels by the orifice up the pipe A, passing through and carrying with it the column of liquid in the pipe, and escaping by the orifice formed by the crossing of the slots—saturating itself with the vapour of the liquid to a degree depending directly on the height at which this orifice is set. From the orifice, the saturated air or gas rises, and is drawn off through the outlet O; while the liquid column, coming out through the orifice at the same time, falls back to the bottom of the upper chamber.

Burners for Acetylene and other Gases.—Schwarz, G. von, of Nürnberg-Ostbahnhof, Germany. No. 17,703; Aug. 15, 1903.

These burners belong to the class in which gas under high pressure is forced through a narrow passage before entering the enlarged chamber of the gas-channel forming its mouth; the chamber being provided with lateral air-holes. The gas is thus compelled to form a thin jet within the chamber, where it is enclosed by a film or envelope of air filling up the space between the jet and the walls of the chamber, thus protecting the top rim of the burner from coming into contact with the combustible gas, and getting covered with lamp-black.

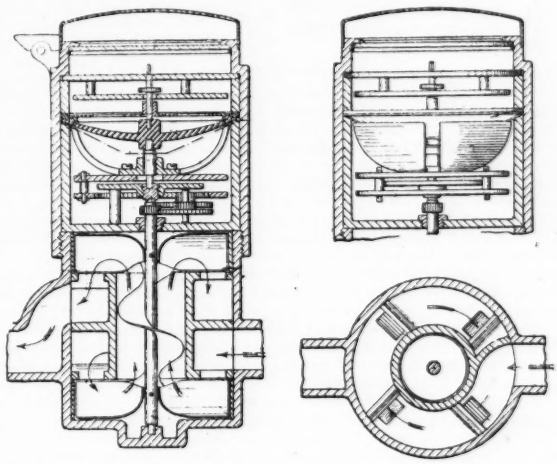
According to the invention, the top series of air-holes are arranged immediately underneath the top rim of the burner-head, instead of (as hitherto) below the middle of the chamber forming the top of the burner. The latter arrangement had for its object to mix the air with

the gas-jet inside the chamber while passing through it; but this invention is to provide air again to the gas-jet when the gas is about to leave the chamber, or rather immediately before its escape.

Several specimens of burners provided with the new arrangement are shown. In the first, the air-holes are bored into the walls of the top chamber. No. 2 shows a specimen in which the air-holes assume the shape of slits provided above the chamber—their direction crossing the vertical axis of the burner. In the third specimen, the air-holes are bored into the walls of the chamber, and the latter is enlarged at its top by assuming a conical shape. No. 4 shows the air-holes bored into the walls of the chamber; the latter being provided with a step so that a second mouth chamber of the burner is formed above the bottom one. The last type is one where the air-holes are bored into the walls of the chamber; the latter forming a second chamber which is enlarged at its top part.

Water-Meters.—Engelfried, G., of Stuttgart, Germany. No. 18,264; Aug. 24, 1903.

Water-meters as heretofore employed in practice, says the patentee, all possess the defect that they are not sensitive enough—since, when only very small quantities of water flow through them, they no longer register. This defect is due partly to faulty arrangement of the vane-wheel and of the inlet and outlet passages, and also partly to the fact that the arbor serving to drive the counting and indicating mechanism has to be packed by stuffing-boxes at the places where it passes through partitions or bulkheads in the meter. By these means, "there result losses by shock and friction, and the resultant resistance must be overcome before any motion of the vane-wheel and of the counting and indicating mechanism can take place. If these resistances are very great, and the instrument is not sensitive, a considerable amount of water can run through the instrument without any registration taking place—that is to say, the instrument is more or less inoperative."



These defects are said to be obviated in the present instrument. This result is attained partly in that the driving of the counting-train is effected by a magnet arranged on one of the arbors of the wheels forming the reduction or transmission gearing and rotating with the arbor—the magnet transmitting the motion of the vane-wheel to the counting-train through a closed partition. By this means, the packing of one of the arbors of the counting-train by a stuffing-box is obviated. Moreover, two vane-wheels connected by a spiral-shaft are arranged to work together in the vane-wheel chamber; the operation of the vane-wheels being assisted by the form of the spiral-shaft.

The illustration shows a vertical central section of one form of the meter, a side elevation (shown partly in vertical central section, the lower part of the apparatus being removed), and a horizontal section through the inlet and outlet ports.

APPLICATIONS FOR LETTERS PATENT.

21,310.—Rosenberg, A., "Automatic gas-igniter." Oct. 5.
21,337.—Macrae, W., "Gas and oil engines." Oct. 5.
21,409.—West, J., "Feeder-box for retort-charging machines." Oct. 5.
21,479.—Frederick, E. E., "Gas-regulators." Oct. 6.
21,507.—Doolittle, P. E., "Carburetting air." Oct. 6.
21,563.—Grafton, W., "Atmospheric gas-burners." Oct. 7.
21,565.—Love, G. R., "Coal-gas retorts." Oct. 7.
21,614.—Pointon, C. E. & J. E., "Gas-producers." Oct. 8.
21,709.—Mees, G., "Power-gas generator." Oct. 9.
21,760.—Clay, J., "A method of making a cheap power gas." Oct. 9.
21,855.—Hemingway, H. W., and Booth, R., "Washing or purifying gas." Oct. 10.
21,898.—Miles, W. P., "Operating valves and the like at predetermined intervals." Oct. 12.
21,964.—Derval, E., "Inclined gas-retorts." Oct. 12.
22,029.—Anderson, C. W., and Higgins, W. B., "Radium self-lighting fork for incandescent burners." Oct. 13.
22,072.—Melhuish, A. G., "Internal combustion engines." Oct. 13.
22,079.—Brown, W. H., and Truckses, J. E., "Mixing and delivering air and gas." Oct. 13.
22,099.—Bergan, J., "Automatically lighting and extinguishing gas-lamps." Oct. 13.
22,201.—Wood, S. H., and Larkin, F. S., "Producing and utilizing gases for power." Oct. 15.
22,209.—Penwarden, C. W. H., "Gas-engines." Oct. 15.
22,211.—Price, S. O., sen., & S. O., jun., "Hot air and ventilating gas-stoves." Oct. 15.
22,228.—Edge, H., "Withdrawing the charge from gas-retorts." Oct. 15.
22,234.—Lanchester, F. W., "Gas-engines." Oct. 15.
22,251.—Gilbert-Stringer, H. J. S., "Generation of combustible gas." Oct. 15.
22,255.—Moore, A. E., and Darch, A., "Incandescent gas-burners." Oct. 15.
22,258.—Scott-Snell, C., "Gas-stoves." Oct. 15.
22,290.—Croissant, H., "Manufacture of water gas." Oct. 15.
22,331.—Pannell, J. F., "The incandescent regulator." Oct. 16.
22,335.—Bollé, C., "Drawing apparatus for gas-retorts." A communication from C. Eitle. Oct. 16.
22,377-8.—Southey, A. W., "Fluid-meter." Oct. 16.
22,392.—Siegenberg, L., jun., "Incandescent gas-burners." Oct. 16.
22,451.—Evered and Co., Ltd., "Incandescent mantles." A communication from C. Weiblen. Oct. 17.
22,457.—Cutler, S., "Side sheets of spiral-guided gasholders." Oct. 17.
22,481.—Weinmann, G., "Distance-operated gas-igniters." Oct. 17.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Crystal Palace Gas Exhibition.

SIR,—There is no intention whatever of postponing the Heating and Lighting Exhibition which we have advertised for December next. The Crystal Palace is committed to it; and it cannot be postponed. I am sorry for the decision of the Gas Engineers' Society, but we must do the best we can without them.

GEORGE COLLINS LEVEY.

Oct. 24, 1903.

SIR,—It was with surprise and regret that I read the article "The Institution and the Crystal Palace Gas Exhibition" in your issue of the 20th inst. There is no doubt that many (among whom we may be included) who have either booked or been negotiating for space, were actuated to a great extent by the Gas Institution lending its support, and undertaking to use its great influence to make the Exhibition a success.

With regard to the question raised, as to there not being sufficient time for the exhibitors to get ready, I can only refer to the old adage, "Where there's a will, there's a way;" and I do suggest that, for the larger proportion of likely exhibitors, two months would be ample time to get together exhibits which would do credit to the occasion, and which should be worthy of the support of the Gas Institution.

Now, Sir, is this question of time the only cause or obstacle? I suggest not, but affirm that a real impediment lies in the fact that a number of the oldest and largest manufacturers of gas apparatus designedly boycott these open exhibitions, rather than meet on an equal footing their younger brethren—preferring to stand on their old and past reputation than run the risk of an open competition.

Some two years back, there was a combined movement by several of the largest and oldest gas-stove manufacturers to get control of the gas-stove section of an exhibition which was being arranged—the object being obvious. Inasmuch as their scheme fell through, the whole of these manufacturers (with the exception of one firm) absolutely resolved to boycott the exhibition—notwithstanding that they had negotiated for space, and had also been very keen, until they found that they could not get the control, as to who were to be allowed to exhibit in the gas-stove section. The one firm referred to above, at the last moment, took space, which was allotted to them for a nominal consideration, owing to the combination having, by their action, practically ruined the exhibition.

All right-minded gas engineers, and the Gas Institution in particular, will, I feel, most strongly condemn such practices as the above; for it is only by open healthy competition, and by the young ideas being allowed to show how they can shoot, that any industry can hope to advance, and place the results of its best efforts before the public.

Even now, with the support of the Gas Institution, I do think that there is still time, for those who are willing, to make the proposed Exhibition a success this year. This would be a starting-point, and then, if the Gas Institution were to create an Annual International Gas Exposition, embracing everything of interest to the gas world, and which would allow of any exhibitor having an opportunity to discuss personally with gas engineers, gas managers, secretaries, and all interested in gas matters, their ideas, improvements, and inventions, there would result an impetus to intelligence and originality, whereby the benefit and knowledge to everyone—theoretically, practically, and commercially—would be unbounded.

C. E. RYDER TERRY,
Managing Director of the Imperial Stove Co.

Leamington, Oct, 24, 1903.

Selling Power at a Discount.

SIR,—Your editorial article in last week's issue, on "How to Sell Power at a Discount," is deserving of immediate attention by gas engineers, and at the same time is remarkable for the hesitancy displayed in accepting the low figure charged for current for motive power by electrical undertakings, as being one correct in principle, and likely to yield an actual profit. That the low charge mentioned for electric power is not only correct in principle, but highly profitable (despite the fact that the rate so charged is less than the average cost of production), can be clearly shown.

In considering the question, it is necessary to lay aside the desire to be guided by the law of averages, which, as you earnestly point out, is oftentimes illusory and conflicting. In order to clearly understand the policy of electric suppliers in having a cheap power rate, we must look at the particular circumstances of electrical undertakings in the generation of current. The following may be taken as supplementary to the example cited in your article. The cost of production is made up of generation and standing charges. These may be divided as follows:—

Cost of Generation.	*Standing Charges.*
1.—Coal.	1.—Salaries and wages.
2.—Water.	2.—Repairs and maintenance.
3.—Oil, waste, &c.	3.—Rent, rates, and taxes.
	4.—Interest and sinking fund.
	5.—Depreciation.

From the above, it will be seen that the cost of generation will increase *in the same ratio* as the number of units generated. Thus, suppose the cost to be 1½d. per unit, this figure would be unvarying, no matter how many or how few units are generated. The standing charges, however, have a reverse effect, and the cost per unit is in inverse proportion, be the production greater or less. Thus, if it costs 5d. per unit under standing charges with a production of 50,000 units, with the production increased to 100,000 units the standing charges obtaining will be reduced to 2½d. per unit.

In Alloa, the Corporation are in the position of buying current in bulk from an Electric Plant Company, with works situated in the vicinity. The charges to the Corporation are £9 per kilowatt of maximum demand, *plus* 1½d. per unit. The maximum demand charge is made so as to cover the entire cost of production if the supply was constant and uniform for one hour per day throughout the year. The number of units consumed for the year ending the 15th of May last was 59,000; and the average price paid by the Corporation was 3·65d. per unit. A number of motors are supplied at a uniform rate of 2d.—this being essentially a day load, a time switch being in operation to prevent the motors coming on at the "peak," unless through a maximum demand indicator. It may be incidentally mentioned with regard to this curtailment of supply to motors in our case, that in large towns no such safeguard is necessary—the motors in use not being at all likely to overlap the demand that is already created. The maximum demand was 58·27 units; and this was charged at £9 per unit. For all current used during certain hours when the "peak" is not on, we pay at the rate of 1½d.; and our charge to consumers for power being 2d., we are gaining a clear profit of 25 per cent. on each unit so disposed of.

Dealing with the question of a differential rate for gas for engines, the factor guiding the practice of electrical undertakings is in great part applicable to gas-works, though not wholly so. A differential rate can only be considered and put in force when it can be shown that by doing so the charge to lighting consumers can be reduced, or at least, not increased. There is one other feature of the stern necessity that must, in the near future, compel all gas companies and corporations to have a lower rate for power. The consideration of such a policy will be seen when we have compelling forces against us in the shape of producer gas plants, now being erected at many large manufacturing works. When steam power has been thrown out, and producer gas manufactured, the cost of the latter is found to be about 2d. per 1000 cubic feet; and having regard to the relative calorific value of producer and coal gas as 120 to 600, coal gas would require to be supplied at about 10d. to 1s. per 1000 cubic feet. Much has been said as to the driving of dynamos by gas-engines, and it need only be pointed out that in large installations this in all probability will be carried out with producer gas, as witness the example of Tunis, where the Gas Company have adopted producer gas and gas-engines as motive power for the electric station.

I regret having taken up so much space, and will leave to some future opportunity the discussion as to how, and to what extent, a special rate for power to gas-engines is profitable.

J. W. NAPIER.

Corporation Gas and Electricity Departments, Alloa, Oct. 24, 1903.

Purification Simplified.

SIR,—In your issue of the 13th inst., you call attention, in an "Editorial Note," to a carefully prepared paper by Herr Burgemeister, of Celle. Without criticizing the abstract published in the same issue, I should like to be permitted to briefly refer to the general question.

You state succinctly that one proposition is to saturate gas as it leaves the retort or hydraulic main with aqueous vapour, &c. This system I have tried at intervals for several years, but have not derived any of the great advantages alluded to. Some years since, I fitted steam-pipes into the ends of the foul-mains; and, so far as I have been able to determine, the only advantage gained has been the cleansing of the mains. One of the disadvantages is that the temperature of the gas is increased, while the heavy condensation reduces the strength of the ammoniacal liquor considerably. I have also used Körtings steam-jet exhauster, the disadvantage of which is also the large quantity of water condensed—so much that the gain in illuminating power is more than counterbalanced. Of course, under general conditions, this exhauster wants using judiciously; while its many excellencies are too well known to comment upon.

It is outside the scope of this letter to consider the scrubbers described, with their exquisitely pretty illustrations of water and liquor distribution; but the remarkable statement that "the gain in ammonia amounted to 1½ per cent. of the coal carbonized" is surprising, as also to read that "in many gas-works the yield of ammonia may be doubled or even trebled," although one recovers somewhat on reading that as much as 21 lbs. of sulphate of ammonia have been obtained per ton of coal carbonized at one works.

All gas engineers—whether German or English—will alike be grateful to Herr Burgemeister for the interesting experiments he has made, and the valuable information he has given respecting the same. It may be hoped that they will lead to further research and inquiry into the whole question of the simplification of gas purification, which is an object desired by all.

EDWARD A. HARMAN.

Huddersfield, Oct. 23, 1903.

The Question of Submitting Plans to a Local Authority.

SIR,—I am desirous of erecting a fitting-shop on our reservoir grounds 2 miles from any residence. We have incorporated in our Acts all the usual General Acts, without which no Water Bill will pass through Parliament in these enlightened law-making days. All the Acts contain the usual clauses—viz., "That we may take lands by agreement, provided that the company shall not deal with such lands so as to create a nuisance, nor on any such lands erect or authorize, or permit the erection of any buildings other than buildings *connected with or necessary for their undertaking*." Section 12 of the Water-Works Clauses Act, 1847 (which now is always incorporated with Water Acts), reads as follows:—

The undertakers may execute any of the following works for constructing the water-works. . . .

(1) Enter upon any lands described in the said plans, &c., dig, and remove trees, stones, &c., &c. . . . .

(2) They may from time to time sink such wells or shafts, and make, maintain, alter, or discontinue such reservoirs, water-works, cisterns, tanks, aqueducts, drains, cuts, sluices, pipes, culverts, engines, and other works, and *erect such buildings upon the lands and streams* authorized to be taken by them, as they *shall think proper* for supplying the inhabitants of the town or district within the prescribed limits with water.

After having passed the plans, &c.—which plans, of course, also passed the local authority—and obtained the supreme authority (parliamentary), the local surveyor again demands plans to be deposited, threatening penalties! Interchange of opinion on water-works law will be most helpful to many of your readers; and a solution to this question will prevent many from incurring unnecessary law costs. If the local authorities can demand plans for such a petty building as this, then the sooner the law is altered the better for all undertakings that are relying on their Acts for protection.

I am told by some water-works engineers that, after all, it is a small matter; and if the authorities demand plans, it is better to furnish them for the sake of peace. But this cannot be safe, or good, practice for those who already hold the supreme authority. For instance, I should use nothing but reinforced concrete throughout—roofing and partitions included—thereby making a much stronger building for half the cost of the orthodox style, and employ my own staff of men; but the surveyor says: "No; you must not deviate from my bye-laws, and objections will be made to the erection of some of your contemplated structures."

I am acquainted with the result of the trial of the *Grand Junction Water-Works Company v. The Hampton Urban District Council* (see "JOURNAL," Vol. LXXI., p. 1581, and Vol. LXXII., p. 381). The company were prevented from erecting a huge, lofty building in a street *beyond the front main wall of the house*, or building, on either side thereof; but I hold this to be a very different case to that I have described, especially if the engine-house was to be 50 feet high, and abutting on the pavement. I am also acquainted with the case of the *Uckfield District Council v. The Crowborough Water Company* (see "JOURNAL," Vol. LXXIII., p. 592, and Vol. LXXIV., pp. 1066, 1253), which was decided against the Company; but the decision would have been reversed if carried to a Higher Court.

I find many of your readers are working under a misapprehension as to the position they hold with regard to depositing plans, and as to the anamalous position they will find themselves in when called on to erect a building that may not appeal to the "Sanitary Committee!" or their "Surveyor."

I shall be grateful to all water-works engineers and managers for an expression of opinion on this subject.

SUPERINTENDENT.

Oct. 12, 1903.

LEGAL INTELLIGENCE.

KINGSTOWN POLICE COURT.—Thursday, Oct. 22.

(*Before Mr.* DRURY.)

Question as to the Depth for Laying a Gas-Main.

The Dublin County Council were to-day summoned by the Alliance and Dublin Consumers' Gas Company, under the following circumstances: The Company proposed to lay a main at Stillorgan Park 2 ft. 5 in. under the level of the roadway; and the Council required them to lay it at 3 feet. They would, however, permit them to lay it at 2 feet if they gave an indemnity against any damage that might be caused to the main by the Council's steam-rollers. The proceedings were taken under section 9 of the Gas-Works Clauses Act, 1847; and the Magistrate was called upon to decide the proper depth at which the main should be laid.

Mr. S. RONAN, K.C., appeared for the plantiffs; Mr. W. J. SHANNON represented the defendants.

Mr. RONAN, in opening the case, said that in 1900 there was a serious litigation between the Gas Company and the County Council as to injuries caused to the gas-mains by the Council's steam-rollers.* In that case, the witnesses for the Council said that where it was required to provide for a weight of 30 tons, or at all events a steam-roller of 15 tons, the main should be laid at a depth of 2 or 2½ feet. In a letter dated June 16, 1899, before the case was tried, Mr. Collen, the County Surveyor, prescribed 3 feet; but one witness said 18 inches, another said 2 feet, and two others said 2 ft. 6 in. The Master of the Rolls decided in that case that it being an old main, laid before steam rolling was introduced, 9 inches was sufficient, and the plaintiffs got their injunction. In the Court of Appeal, Lord Justice Fitzgibbon said the Gas Company must understand that all lawful modern appliances for making and repairing the roads could be used where there were no pipes already properly laid, and that in the future, and also with respect to pipes laid since the introduction of steam-rollers, the Company must lay their pipes at such a depth, and in such a manner, as not to be liable to injury from the use by the defendants of what was now a reasonable means of repairing the roads.† The present case was one of a new main, and, therefore, what had to be decided was how it was to be properly laid "in such a manner as not to be liable to injury from the use by the defendants of what was now a reasonable means of repairing the roads."

Mr. DRURY: For the use of a steam-roller up to what weight?

Mr. RONAN: A reasonable steam-roller should weigh 15 tons. Continuing, he said the Master of the Rolls asked Mr. Cowan, the Engineering Inspector of the Local Government Board, what was safe, not what was ideal. In this case, Mr. Collen wanted the ideal, not the safe, standard. But Mr. Cowan said: "In my opinion no pipe would be safe under a road with ordinary traffic at a less depth than 18 inches;" and he added that he would like more if he could get it. What his Worship had to decide was what was reasonably safe, and not what was ideal. The Company had pursued a very reasonable course. They took the evidence of defendants themselves in the action before the Master of the Rolls, which was practically 2 feet. But Mr. Collen had selected an ideal depth of 3 feet; and he gave them the alternative that if they would agree to indemnify the County Council against all claims for accidents, they might have 2 feet.

The following evidence was then given on behalf of the Company.

Mr. *Charles Hunt* said from 1872 to 1902 he was the Gas Engineer of the Birmingham Corporation, who supplied seven outside district Local Authorities. For the first five or six years they laid the pipes at from 1 foot to 1 ft. 6 in., according to circumstances; but after the introduction of steam-rollers, they found 2 feet was a sufficient depth. He was also a Director of the Crystal Palace District Gas Company, who supplied four Urban District Councils whose roads were steam-rolled, and the mains were laid with a 2-feet covering. They had never had any difficulty with steam-rollers.

In answer to Mr. SHANNON, witness stated that in Birmingham the gas suppliers and the road authority were the same bodies.

Mr. *W. R. Herring* said he had never had any trouble with a main laid at a depth of 2 feet. When he was at Huddersfield, in the paved streets they laid the mains at 1 ft. 9 in., and in the macadamized roads at 2 feet. In the district in which he was engaged at present, he had under his control a greater part of Midlothian. In the towns the depth of the mains was 1 ft. 9 in.; but in the country districts they laid them at 2 feet. There had never been any exception taken to this by the surveyors of the outside districts. He would not put the mains any deeper, because it would be waste of money.

In cross-examination by Mr. SHANNON, witness said he had never received any approval from the county officer of the depth at which the mains had been laid, because he had never asked for it beyond serving the statutory notice.

Mr. *E. H. Waterfield*, the Chief Engineer of the Company, gave evidence to the effect that Mr. Harty (the Borough Surveyor) was satisfied with a depth of 2 feet in the city. In this case they proposed to lay the main at Stillorgan Park at 2 ft. 5 in., because this was the level of the existing main, which they proposed to extend.

In answer to Mr. SHANNON, he said the main leading from the Rathmines main to the Portobello Barracks was laid at a depth of 3 feet, but the War Office had paid for that.

Mr. *G. F. Waterfield* proved a number of returns as to the depths at which mains were laid in the city, and said the level of 3 feet at Portobello was only at the portion of the main crossing the Rathmines Road from the trunk main; but when it got into the private grounds of the Portobello Barracks, it was only 2 feet below the surface.

Mr. SHANNON, in opening the case for the defendants, said the judgment of the Master of the Rolls only decided that in the case of the old mains put down by the Company, they were properly laid, inasmuch as they were placed at a certain depth to withstand what was then the ordinary traffic; and throughout the judgment he referred to 30 or 40 years ago, when steam-rolling was unknown. His Lordship also referred to the fact that under the Act the county officer was the authority to say that the mains were properly laid. In the present case, Mr. Collen had prescribed that 3 feet was the proper depth; but the Company insisted that it was 2 feet. If this was so, why did they hesitate to give the indemnity?

Mr. *William Collen*, the County Surveyor for Dublin, said that in his opinion 3 feet was the proper depth; but he had made an offer to the Company which he thought they would have jumped at. From his experience, the pipe-laying of the Company was about the worst that could be carried out. No proper care was taken in the laying of their pipes, or there would be fewer disputes.

In answer to Mr. RONAN, witness said he understood the Dublin Corporation had a special steam-roller of 5 tons to go over the gas-mains. If he were appearing for the Company, he would say that 2 feet would be quite safe.

Mr. RONAN: Would you tell the truth if you were for the Company?

Witness: It would be fairly safe from any risk. If I were the Company's Engineer, I should have no hesitation in laying it at 2 feet.

Mr. DRURY said he did not see why he should go through the formality of adjourning the case to consider his judgment. He was asked to decide whether or not 2 ft. 5 in. was a sufficient depth. He held that it was; and he would make the order sought, with £10 costs against the defendants.

* See "JOURNAL," Vol. LXXV., pp. 752, 815, 1733.

† *Ibid.*, Vol. LXXVI., p. 100.

Falsifying the "Veritas" Trade Mark.

At the Swansea Police Court last Thursday, Jacob Rosainsky was summoned for offering for sale certain incandescent mantles to which a trade mark so nearly resembling that of Messrs. Falk, Stadelmann, and Co., Limited, of Farringdon Road, as to be calculated to deceive, had been falsely applied. The proceedings were taken under sections 2 and 12 of the Merchandise Marks Act. Mr. Villiers Meager prosecuted; Mr. Viner Leeder appeared for the defendant. There was a further summons calling upon the defendant to show cause why the goods were not liable to forfeiture. Mr. A. M'Lelland, Manager to the prosecutors, said his firm manufactured "Veritas" gas-mantles, and had a factory in Berlin. All the mantles they sold were marked "Veritas," which was a registered trade mark, and the boxes in which they were sold were similarly marked. On the 9th inst. he went to defendant's shop, and found a dozen mantles in the window marked "Veretis." He sent in a lad who bought three for 1s. These were not manufactured by his firm, and were marked in various ways; but the boxes were labeled "Veretis." Trevor Jenkins, a boy, proved purchasing the mantles, saying he asked for "Veritas" mantles. Mr. Leeder said the defendant was a Russian Pole, who had come to England utterly ignorant of the laws. He had been turned out of his own country, and had come to the "general dumping ground." He acted quite innocently, and had not the slightest intention to deceive. The Bench imposed a penalty of 10s. and costs. Mr. Leeder asked that the defendant should not forfeit the mantles, but that they should be sent back to Germany, and the people supplying them ordered to refund the money paid for them. Mr. Meager said the mantles would be equally fraudulent in Germany; and the Bench made an order for their destruction.

MISCELLANEOUS NEWS.

GAS AND WATER ORDERS OF LAST SESSION.

The report of the Board of Trade on their proceedings under the Gas and Water Works Facilities Act, 1870, during the past session, has just been issued. It states that in December, 1902, twenty-three applications were made to the Board for Orders—twelve relating to gas, eight to water, and three to gas and water undertakings. The amount of capital proposed to be authorized was £514,500 by shares and £154,049 by loan; £213,500 of share and £60,666 of loan capital being for gas, and £169,000 share and £48,083 loan capital for water purposes. The remainder—viz., £132,000 share and £45,300 loan capital—was needed for gas and water purposes combined.

The applications for Gas Orders were in regard to the Brading Harbour district, Cobham, Conisbrough, Crossgates (with Halton and Seacroft), Hailsham, Herne Bay, Pembroke Docks and town, the Riddings district, St. Ives (Hunts), Tipperary, Wexford, and the Woking district. Eight applications—viz., those relating to the Brading Harbour district, Cobham, Crossgates, &c., Herne Bay, Pembroke, Riddings, St. Ives, and Woking—were in respect of undertakings already authorized by Special Acts or Provisional Orders, and chiefly sought the following powers: The Brading Harbour District Gas Company, to maintain and continue the existing gas-works at St. Helen's, in the Isle of Wight; the Cobham Gas Company, to raise additional capital; the Crossgates, Halton, and Seacroft Gas Company, Limited, to purchase additional lands, construct works, convert their capital into stock, and raise more money; the Herne Bay Gas Company, Limited, to extend their limits of supply and raise additional capital; the Pembroke Docks and Town Gas Company, Limited, to construct additional gas-works and to raise more capital; the Riddings District Gas Company, to extend their limits of supply and raise additional capital; the St. Ives (Hunts) Gas Company, Limited, to raise further capital; and The Woking Order was to amend the Woking District Gas Order, 1901, in regard to the distribution of revenues applicable to dividend. Four applications—viz., those pertaining to Conisbrough, Hailsham, Tipperary, and Wexford—related to unauthorized gas undertakings, and were for power to maintain and continue existing gas-works, and to manufacture and supply gas.

Objections were lodged against several applications, and were fully considered by the Board; inquiries being held in such cases as appeared to be necessary. The application by the Tipperary Gas Company, Limited, was refused, after inquiry; but in each of the remaining cases an Order was granted, subject to certain modifications and amendments. Inquiries were held in regard to three applications—viz., Pembroke, Tipperary, and Wexford.

Objections were lodged against the Pembroke Docks and Town Gas Order by the Corporation of Pembroke, and certain of the residents and owners in the vicinity of the proposed new works; and the Board of Trade appointed Mr. Ingram B. Walker to hold a local inquiry, and to report to them on the matter. He recommended that the Order should be granted subject to the following conditions: That the manufacture of gas and residuals on the new site should be forbidden; that the maximum price of gas should be reduced from 5s. 6d. to 4s. 6d. per 1000 cubic feet; that the total authorized share capital should be fixed at £37,000, consisting of £10,000 raised under the Order of 1871, £2000 raised without authority, and £25,000 of additional capital. The Board granted the Order with the modifications suggested.

The Tipperary Gas Order was objected to by the Tipperary Urban District Council and the Manager of the Bank of Ireland. The Board directed a local inquiry to be held, as the result of which it appeared that it was not possible to fix a maximum or standard price for gas which would be fair to the consumer and acceptable to the promoters; that the existing capital was considerably in excess of the amount expended on the undertaking; that the present site was unsuitable for the manufacture of gas; and that it was not desirable that statutory authority should be given for the extension of the works thereon. In these circumstances, the Board refused to grant an Order.

The consent of the Corporation of Wexford required in respect of the application for the Wexford Gas Order was refused; and the Corporation also lodged objections to the provisions of the Order in detail. The Board directed a local inquiry to be held,* as the result of which an agreement was arrived at between the promoters and the Corporation. The Board therefore granted the Order, and gave effect to the terms arranged between the parties, including the insertion of a clause requiring the promoters to sell the undertaking to the Corporation in certain circumstances.

In the following Orders, a maximum price for 1000 cubic feet of gas was fixed: Brading Harbour and District, 5s. 6d.; Conisbrough, 5s.; Hailsham, 6s.; and Pembroke Docks and Town, 4s. 6d.—power being reserved to the Board (except in the first-named Order), after a defined period, to alter the maximum price or to substitute a sliding-scale. In the Wexford Gas Order, a standard price of 3s. 4d. per 1000 cubic feet was fixed, with a sliding-scale as to price and dividends.

The Crossgates and Wexford Gas Orders contain restrictions with regard to the purposes for which the scheduled lands may be used. The Pembroke Order also has provisions authorizing the inclusion in the capital of a sum of £2000 raised by the issue of shares in excess of the Company's powers. Agreed clauses relating to the purchase of the undertaking by the Local Authority were inserted in the Hailsham and Wexford Gas Orders; and a similar agreed clause relating to the purchase of a portion of the undertaking by the Neyland Urban District Council was inserted in the Pembroke Order after the introduction of the Confirmation Bill. In the Conisbrough Order, the dividend on the original capital was limited to 9 per cent. An illuminating power of 14 candles was prescribed in the Cobham, Hailsham, Pembroke, and Wexford Orders; and of 15 candles in the Conisbrough Order.

* See "JOURNAL," Vol. LXXXII., p. 163.

The applications for Water Orders were in respect of Amersham, Beaconsfield and the district, Bolsover and the district, Goring and Streatley district, Leatherhead and the district, Ludgershall, Mid-Kent, Rodbourne Cheney, and St. Neots. Five applications—viz., those relating to Amersham, Goring and Streatley, Leatherhead, Mid-Kent, and St. Neots—were in respect of undertakings already authorized by Special Acts or Provisional Orders, and sought the following powers: The Amersham, Beaconsfield, and District Water-Works Company, Limited, to extend their limits of supply, construct and maintain additional water-works, and raise further capital; the Goring and Streatley District Gas and Water Company, Limited, to construct and maintain additional water-works, extend their limits of water supply, raise more water capital, and change the name of the Company; the Leatherhead and District Water Company, to raise further capital; the Mid-Kent Water Company, to extend their limits of supply; and the St. Neots Water Company, to raise additional capital.

The Bolsover and Ludgershall Orders were applied for by individual promoters, and sought to authorize the construction of new water undertakings. The Rodbourne Cheney Order was sought by the North Swindon Estate Company, Limited, to authorize them to maintain and continue their existing water undertaking, and to supply water in an extended area. The district proposed to be included in the limits was claimed by the Swindon Corporation to be within their authorized area of supply; and the scheme was otherwise opposed. After some negotiations had taken place, the application for the Order was withdrawn. With this exception, Orders were granted by the Board in each case, subject to such modifications and amendments as appeared to be necessary.

In the case of the Amersham, Beaconsfield, and District Order, a formal hearing of the objections took place at the office of the Board of Trade, as the result of which the Board decided to strike out the parish of Gerrard's Cross from the proposed extended limits of supply. This decision was objected to by the Bucks County Council, who subsequently lodged a petition in the House of Commons against the confirmation of the Order. In the case of the Goring and Streatley Order, objections were lodged by various local and road authorities, and by landowners and others; and the Board appointed Mr. Ingram B. Walker to hold a local inquiry, and report to them upon the application. As the result of the inquiry, he recommended that the Order should be granted, subject to the omission of the parishes of Cholsey, Moulsford, and Mapledurham from the proposed extended limits of supply, and to the reduction of the proposed charges for water supplied in bulk. The Board granted the Order with the modifications suggested.

The proposals contained in the Mid-Kent Order were approved of by all the parties concerned with the exception of the Borden Parish Council, who withheld their consent. The promoters, therefore, asked the Board of Trade to dispense therewith. The Board accordingly held an inquiry at their office, and invited the attendance of representatives of the Borden Parish Council; but no one appeared. The promoters produced a letter from the Milton Rural District Council, in whose district the parish of Borden is situated, stating that the Council, whose duty it is to see that the district has a proper water supply, were in favour of the parish being included in the Order, and that the Parish Council had not intimated to the District Council their objection to the proposed scheme. The Parish Council had not lodged any objection with the Board in regard to the application; and, in the circumstances, it did not appear to the Board that there was any ground for refusing to grant the promoters the statutory powers asked for. They therefore decided to dispense with the consent of the Parish Council, and grant the Order.

The Leatherhead Order contains provisions authorizing the inclusion in the capital of the Company of certain shares issued in excess of their statutory powers; and the St. Neots Order has one preserving the priority of existing debenture stock and mortgages. The Bolsover Order contains agreed clauses relating to the purity and hardness of water, and the purchase of the undertaking by the Bolsover Urban District Council. The individuals promoting the Order having formed themselves into a limited liability Company, they are named in the Order as the undertakers.

The applications for Gas and Water Orders were in respect of Aldershot, St. David's, and South Holderness. The first two related to existing authorized gas and water undertakings, and sought the following powers: To enable the Aldershot Gas and Water Company, Limited, to raise additional capital and to extend their existing gas-works; and to authorize the St. David's Water and Gas Company, Limited, to raise more money for the purpose of their water and gas undertakings; and to amend certain provisions of their Act of 1899. The South Holderness Order sought to authorize Richard Samuel Emerson to construct and maintain gas and water works, and to supply gas and water within the parishes of Preston and Paull, and the borough and parish of Hedon, in the East Riding of the county of York.

Four Bills were introduced into the House of Lords on the 4th of May to confirm the Orders granted by the Board—viz., the Gas Orders Confirmation Bills (Nos. 1 and 2), the Water Orders Confirmation Bill, and the Gas and Water Orders Confirmation Bill. A petition was lodged in the House of Lords by the Aldershot Urban District Council against the last-named Bill, in respect of the Aldershot Order; but the Bill passed without amendment. A further petition was lodged in the House of Commons by the Council, but was withdrawn. A petition was lodged in that House by the Bucks County Council against the same Bill, in respect of the Amersham Order; and a petition against alterations was lodged by the Rickmansworth and Uxbridge Valley Water Company. The petition of the Council was withdrawn, subject to the insertion of a clause agreed with the promoters, relating to the supply of water by the undertakers outside the county of Bucks. The Board of Trade procured the insertion of the clause in the Order; and the further stages of the Confirmation Bill were unopposed. The Royal Assent was signified to each of the Bills on the 11th of August.

The number of Orders applied for since the passing of the Gas and Water Works Facilities Act, 1870, is 590; and the Board of Trade have made 546, of which 535 have been confirmed by Parliament.

FREE SUPPLY OF GAS-COOKERS IN MANCHESTER.

Last Friday, Alderman Gibson, the Chairman of the Gas Committee of the Manchester Corporation, was thanked by the members for his services during the past year. In acknowledging the compliment, he gave some statistics showing the effect of the Committee's procedure with regard to gas-cookers. He said that on the 24th of June the payment for the hire of cookers was abolished, and the policy was adopted of supplying every householder who wanted one with a cooker, in the hope thereby of producing a greater day-load on the gas-works, as well as of enabling people to economize in the matter of coal, and so limit the quantity of carbon emitted into the Manchester atmosphere. The chief motive actuating the Committee—that of bringing grist to the mill of the Gas Department—seemed likely to be justified by success. During the first three months of the experiment, the daily consumption of gas between the hours of 10 a.m. and 1 p.m., when the midday meals were in preparation, had gone up to the extent of 9 per cent. There had also been a marked increase in the consumption of gas between the hours of 5 and 6 o'clock a.m., within the same period. The Committee's policy had necessitated a large outlay of capital. The department had supplied, and was supplying, on an average 200 cookers per week. The Committee had been enabled to purchase these appliances in such large quantities as to obtain them at a reduced price, which enabled them to effect a saving practically equivalent to the amount they would have received for one quarter had the cookers been let out on hire. During the last half year, there had been a total increase of about 1500 in the number of gas consumers, and a total additional consumption of gas of 1⅛ per cent., compared with the corresponding period of last year. It was satisfactory to learn that, in spite of the extra consumption through the cookers, there were fewer complaints than in the past concerning the gas bills.

POLITICS ON THE LEEDS GAS COMMITTEE.

When presiding over an election meeting at Leeds last week, Mr. Kinder, a member of the Town Council, took occasion to criticize some remarks of Alderman Lowden in reference to the work of the Gas Committee. He said that, if they took the years from 1888 to 1895, they would see how eight years of Liberal management compared with eight years of Tory management. In these eight years, the Gas Committee made a profit of £22,215. Of the eight years of Tory rule, six years showed a profit of considerable dimensions. One year the profit was a sovereign; and in 1892 there was a loss of £19,535. During the last of the Tory eight years, the profit was £11,018; whereas in the last of the Liberal eight years the profit amounted to £33,718—a sum which had never been approached by the Tory party. Another important point was the price charged for the gas. During the Liberal eight years the price was 1s. 10d. per 1000 cubic feet two years, 2s. one year, 2s. 2d. three years, 2s. 3d. one year, and 2s. 4d. one year—the average price being 2s. 1⅛d. The Tories during the eight years charged 2s. one year, 2s. 1d. one year, 2s. 2d. two years, and 2s. 3d. four years—the average price being 2s. 2¼d. This advantage in price would more than compensate for the slight advantage to the Liberal party in regard to the price paid for coal, &c. But a more important point was that during seven of the eight Liberal years gas of 19-candle power was supplied. The Tory party never had supplied gas of this quality; and when he told them, on the authority of the Managers of the gas-works, that 1-candle power meant a saving of £20,000 a year, they would see how important this was. During the seven years the Liberals supplied gas of 19-candle power, they gave the ratepayers in quality £140,000. But the Liberals had 6¼ years of meter-rents at £1000 a year, which the Tories had not. This made a total of £62,250, which, deducted from £140,000, left £77,750. Adding this sum to the actual profit of £22,215 made during the Liberal eight years, there was a total of £99,965, against the actual profit of the Tory eight years of £66,532, to achieve which they (the Tories) had increased the capital account by £470,000.

GAS APPRECIATED IN WESTMINSTER.

Improved Public Lighting—Gas for Workmen's Dwellings.

At the Meeting of the Westminster City Council on Thursday, the Engineer (Mr. W. H. Bradley, Assoc.M.Inst.C.E.) submitted a scheme for improving the lighting of Victoria Street and Broad Sanctuary. At present these localities are lighted by 69 single-burner and 10 quadruple-burner lamps, at a cost of £346 11s. per annum. The Gaslight and Coke Company offered to convert the existing lanterns and substitute double burners in the single lamps and triple burners in the quadruple lamps, carry out the work entailed by the suggested alterations free of charge, and supply new "C" burners in exchange for the Kern burners at present in use. The annual charge for gas under this scheme would be £476 7s., or an increase of £129 16s. a year; but it was stated that the increase in effective lighting would be more than 50 per cent. Upon the recommendation of the Engineer, who advised that the proposed improvement in lighting was desirable, it was decided to accept the offer of the Company.

On the same occasion, the Housing Committee reported that they had considered the subject of the lighting of the new workmen's dwellings in Regency Street. Messrs. Joseph, Son, and Smithem, the Architects, estimated the cost of each system as follows:—

	Electric Light.	Gas.	Oil.
One-room tenement . . .	6d. ..	6½d. ..	7d.
Two ,, ,, . . .	7 ..	7 ..	9
Three ,, ,, . . .	8 ..	8 ..	11
Four ,, ,, . . .	8 ..	9 ..	13

The advantages of gas to tenants would be that during the summer they could use gas cookers or grillers, which would do away with the necessity for fires. The Gaslight and Coke Company were prepared to run mains through the dwellings free of charge, provided the penny-in-the-slot system was adopted. The cost for installing the electric light would be £1000. It was resolved that gas be adopted; and that it be supplied on the penny-in-the-slot principle.

GAS AT THE BREWERS' EXHIBITION.

The heterogeneous collection of machinery, appliances, and produce brought together every year at the Agricultural Hall, Islington, under the title of the Brewers' Exhibition and Market, only calls for notice in our columns on account of the opportunity it affords for bringing under the notice of the visitors, of whom there are always unusually large numbers, the capabilities of gas as a producer of light, heat, and power. It is in respect of its utility in the first-named capacity that the exhibition which closed on Friday—the twenty-fifth of the series—is specially noteworthy. First and foremost stands the brilliant display of light made by Moffat's, Limited, with their "Lucas" lamps. Not only were these shown in various sizes for general purposes, but their special adaptability for lighting billiard-tables was well exemplified. At another stall, the "Star" inverted incandescent gas-burner, an illustrated description of which was given in the "JOURNAL" for the 13th inst., was demonstrating how powerful a light (70 candles, according to cards attached to the lamps) could be produced with a consumption of only 2½ cubic feet of gas per hour. The stall was surrounded by the burners, placed in various kinds of globes; and, on the whole, they were doing very good duty. A large stand with a fine assortment of licensed victuallers' glass and china on view was effectively lighted by incandescent gas, as were two neighbouring stalls.

Passing from the lighting to the heating and cooking appliances, the stand of the Richmond Gas Stove and Meter Company, Limited, must be noticed first, as containing the most representative collection of stoves and kitcheners. Here were to be seen, well displayed by the aid of incandescent gas-burners, all kinds of gas-cooking apparatus for hotels, clubs, &c., special grillers, hot closets, carving-tables, and all requirements for restaurants, together with gas fires and stoves for ordinary households. The Company secured a better position than hitherto; and their display was attractive in the highest degree. Another good show was that of Messrs. S. Clark and Co., who had on view bar and heating stoves, counter urns, and their patent syphon stoves for use without flue. The Eagle Range and Gas-Stove Company, Limited, occupied their usual place, and showed two ranges and a grate in operation. Messrs. Ritchie and Co. had on view their "Lux Calor" condensing stoves.

It only remains to say that the use of gas for motive force was exemplified by Messrs. Crossley Bros., Limited, by means of 26½ and 10½ brake horse power gas-engines; the latter being combined with a dynamo for lighting the stand. They also had a small gas-engine capable of developing ¾-horse power as a regular working load. The National Gas-Engine Company, Limited, and the Forward Engineering Company, Limited, had stands; while the well-known "Stockport" engines are permanently located in the hall. Though motors of only the ordinary sizes were shown, all the makers are, we believe, engaged in developing others of very much higher power.

SALES OF STOCKS AND SHARES.

At the Mart, Tokenhouse Yard, on Tuesday, Mr. Alfred Richards resumed his sales of stocks and shares in gas and water companies. The first lots offered consisted of £10 "C" shares in the Harrow and Stanmore Gas Company—a new issue by order of the Directors. These shares rank for a dividend of 7 per cent., subject to the sliding-scale; the last dividend on similar shares having been at the rate of £6 9s. 6d. They fetched prices ranging from £11 10s. to £11 15s. each. A parcel of 107 fully-paid £10 ordinary shares in the Barking Gas Company, carrying 7 per cent. dividend, realized £13 5s. per share. A fresh issue of sufficient new ordinary 5 per cent. stock of the Southend Gas Company as, with the premiums, would realize £13,706, was next put up, and was all disposed of at prices ranging from £104 (five £100 lots) to £105 (one lot); the purchasers taking the dividend, at the rate of 5⅓ per cent. per annum, accruing from the 1st prox. Another new issue—500 ordinary £10 shares in the Great Yarmouth Water-Works Company—was afterwards submitted for competition. These shares rank for a maximum dividend of 7 per cent. per annum, and on similar shares 4 per cent. has been paid for the past seven years. They were sold at from £10 to £10 10s. each. The last lots consisted of a new issue of £5 "B" (7 per cent.) shares in the Romford Gas and Coke Company, Limited, carrying, as from the 1st prox., a dividend at the rate of 9 per cent.; and they fetched prices ranging from £8 to £8 5s. apiece. At a recent sale by Messrs. Neve and Sons, some parcels of "D" stock of the Tonbridge Gas Company fetched an average price of £182 per £100 of stock. The last dividend paid was at the rate of 8⅓ per cent. On another occasion, four shares of the 1849 capital of the Bury St. Edmunds Gas Company were sold by auction at £19 5s.

The Removal of the Matlock Bath Gas-Works.—In the Act of 1896, by which the Matlock Bath gas undertaking was acquired by the District Council, there was inserted a clause which made the removal of the gas-works to a new site imperative seven years after the date of the transfer. This period will expire on Jan. 1 next; but the Council have approached the Matlock authorities (the works being in their district) for an extension of the time. A conference between deputations representing the two Councils has taken place; and an agreement has been arrived at. This, it is stated, will save Matlock Bath an immediate expenditure of £10,000.

CEARA GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Friday, at the London Offices, No. 9, Queen Street Place, E.C.—Mr. J. DARELL BLOUNT in the chair.

The SECRETARY (Mr. George R. Guyatt) read the notice convening the meeting, and the Auditor's certificate, as required by the Company's Act, 1900. The report and accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said the shareholders would have perceived that, on the whole, there was an improvement compared with the previous year, especially in the cost of coal, which showed a saving of about £1200, while the gas accounted for presented an increase of 900,000 cubic feet. Against this, there had been an increase of £1200 in the cost of maintenance. This, however, was principally due to the writing off of a sum of £1000 standing to suspense account for the new retort-settings. The accounts of the previous year showed this £1000 standing to suspense account. The other differences in the accounts were not important; and the net result was a gain of nearly £300 over the profit of the preceding year. This, although not large, was yet a satisfactory result. He regretted that the indebtedness by the Government for public lighting still continued. Some arrears had been paid; but the debt stood at present at about £8600. The Directors had used every means in their power to obtain a settlement, but with only partial success. The delay in payment was the more inexcusable as the trade of the Province was now in a much more satisfactory condition, and the default could no longer be attributed to financial difficulties consequent on the drought experienced throughout the Province during recent years. In their newly-appointed Manager (Mr. George Martin), they had a man possessing great tact in treating with the authorities; and the Directors had every confidence in him. They therefore trusted that a liquidation of the account might not be long delayed. It was unfortunate, however, that, though the dividend had been earned, it could not be distributed until the Company were in funds to do so; and this could only be when payments were made by the Government of Ceará.

Mr. F. A. WALLROTH seconded the motion, which was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. A. J. KING, a dividend was declared at the rate of 10 per cent. on the preference shares, less income-tax, and of 4 per cent. on the ordinary shares, tax free.

Proposed by the CHAIRMAN, and seconded by Mr. F. W. BROTHERS, Mr. F. A. Wallroth and Mr. Thomas Guyatt, the retiring Directors, were re-elected.

On the motion of Mr. R. M. LONG, seconded by Mr. T. M'MAKING, Mr. Magnus Ohren was re-appointed Auditor.

Moved by Mr. M'MAKING, and seconded by Mr. OHREN, the Chairman and Directors were heartily thanked for the way in which they had brought the affairs of the Company through troublesome years.

A similar recognition was also made of the services of the officers and staffs both in Ceará and London.

The CHAIRMAN remarked that, before the proceedings closed, he should like to say that he thought the Company's prospects were more encouraging than they were last year. Mr. M'Making, their late Engineer and Manager, was present, and he should like very much if he would give the shareholders his ideas in regard to Ceará and the condition of the province.

Mr. M'MAKING said he thought the position of the State of Ceará at the present time was very much improved. The rains seemed to have resumed their normal course. Consequently, the cereals and cattle exportation had re-commenced; and the receipts of the Province from these sources had greatly improved. Then he understood that the Province had received the permission of the General Government to levy a tax on all goods imported into the Province from other provinces, which would enable the Province to face these periodical droughts with greater strength, and they would be able to meet their obligations better.

This concluded the proceedings.

BRIXHAM RATEPAYERS AND THE GAS-WORKS.

The ratepayers of Brixham, South Devon, assembled in public meeting last Tuesday to consider a proposal by the District Council that the gas-works should be purchased and reconstructed. A similar recommendation was considered in November last, and was rejected. Since that time the ownership of the works has changed, and is now vested in Messrs. Schultz, of London. These gentlemen, it is stated, bought out the old Company for £3444, and have since spent £950 on additional land, &c. The District Council were originally offered the works by the old Company at practically the same price as was paid by the present proprietors. Messrs. Schultz and Woodall now put the figure at £6600, and the Engineer consulted by the Council strongly advised them to close with the offer and gradually improve the works themselves. It was estimated that an outlay of £7000 was required on new mains, a new holder, and other plant. The sum required for interest and sinking fund on a total expenditure of £13,600 was calculated at £742; while the profit from the undertaking last year was £574—showing a deficit of £168. It was suggested that this sum would be more than made up in a few years by the increased consumption of gas, and by economies effected through the improvement. Hitherto the consumption of gas has been small; the make being only 8 million cubic feet per annum, and the population 8500. There is therefore good reason for anticipating a considerably increased consumption when the conditions are favourable to meeting it.

The Chairman of the District Council (Mr. J. B. Williams) presided over the meeting, and said the Council were of opinion that, as the governing body of the town, they should have a controlling voice in any lighting scheme for the public generally. They would be able to supply gas at a cheaper rate than a company; and the works would be at once remunerative, or nearly so, and their value to the consumers and ratepayers would increase. It was better to purchase for £6600 than to oppose, at a considerable cost, Messrs. Schultz and Woodall's application for a Provisional Order. If it was decided that purchase was not desirable, they must remain in the hands of the present owners, who held the key of the situation. Considerable discussion followed, in which it was suggested that the Council should proceed to give effect to their Electric Lighting Order; and criticism was passed upon the action of the Council in agreeing to give Messrs. Schultz and Woodall 50 per cent. more than the works cost these gentlemen. It was also suggested that if the undertaking were left in the hands of the present owners, and they raised the price of gas, the Council could introduce competition in the form of the electric light. In the end, the meeting decided unanimously not to adopt the purchase scheme.

ELECTRIC LIGHTING NOTES.

Worcester by Candle-Light.

Considerable inconvenience was caused in Worcester on Thursday night by the partial failure of the electric light. It was discovered at the electricity works early in the morning; but it was not until the afternoon that the cause was traced to a short-circuit on a high-tension main, and the staff were not able to get the light on by the evening. Most of the principal streets were on another circuit, and the fact that the shops were shut for the half-holiday saved many tradesmen inconvenience. Most of the clubs and hotels had to resort to candles and lamps; but the Theatre and the Foregate Hall—in use as a music hall—had alternative gas installations to permit of performances being given, though at the former oil-lamps and Japanese lanterns had to be hastily collected to light the lounge, corridors, and exterior.

The Cost of the Barnstaple Electric Light Undertaking.

A special meeting of the Barnstaple Town Council was held a few days ago in order that the Mayor (Mr. H. Barrett) might submit a statement in reply to attacks which were made on the financial position of the electric lighting undertaking. The charges had reference in particular to the large expenditure on extras in connection with the erection and equipment of the works. The Mayor said that the Engineer's estimate for lighting the compulsory area was £21,450, and the Council obtained power to borrow £21,600. The original contracts amounted to £14,657, and there were extras to the extent of £3614, and Engineer's fees, &c., £1989. The total amount chargeable to the capital account was £20,488; so that they were well within the estimate and their borrowing powers. The Mayor added that he believed that at the end of the first year's working the profit would be found sufficient to pay not only the interest on the capital, but a considerable sum in reduction of the principal. Mr. S. N. Petter criticized the Mayor's figures, and said he failed to see where there was the saving of thousands of pounds in placing the contracts for which credit had been claimed. Mr. G. W. Lindsley said it was extravagant to expend £5500 in housing £7000 worth of machinery. He thought they ought to go into the question of public lighting. The gas bill for nine months was only £43 less than for the corresponding period of last year; and taking into account the amount paid for electricity, it meant that £400 had been added to the cost of lighting. It was true the lighting was better; but it was not worth the extra cost.

An Electric Light Venture at Elland.

The works which the Elland District Council have erected for the supply of the town with electricity were formally opened on Saturday, the 17th inst. They are the outcome mainly of the energy of Mr. S. Dyson, the Chairman of the Electric Lighting Committee; and they have been put up, from the designs of Mr. Walter Emmott, at a cost of about £16,000. They are combined with one of Messrs. Meldrum's refuse destructors. A dinner was given by Mr. Dyson to celebrate the event; and, in the course of a reply to the toast of his health, he assured the company that the town had an electric light station which, for kilowatt output, was second to none in Great Britain. The plant would light 10,000 eight-candle lamps as easily as 500, while the cost was the same. He pointed out that the undertaking could not be expected to pay the first year, as it took time to get hold of customers; and therefore he wished to prevail upon every gentleman in the town to study his own interests and adopt electric lighting. We shall be interested to see how far they will do so. The cautious words of the worthy councillor are in striking contrast to his sanguine prognostications as to the success of the scheme on the occasion of the inquiry held by the Local Government Board prior to the granting of the loan. He then spoke of estimated profits so large that they would not know how to get rid of them. According to a local paper, the difficulty will be how to discover them at all. The Engineer's estimate to obtain the small credit balance of £113 for the first year's working was based on the assumption that there would be 6000 eight-candle lamps connected, with an average consumption of 12 units per lamp, and electricity selling at 5d. per unit. It has, however, been decided to charge only 4d.; and yet on the opening day the demand for current was equivalent to only about 800 lamps of the above-named power. The amount of business must be very considerably augmented before it will produce the unwieldy mass of profits foretold by Mr. Dyson. Meanwhile, the Gas Company will continue the "forward" policy they have initiated; and we do not think they will suffer much harm from their competitor—except in respect of the additional burden they may have to bear as large ratepayers.

Alleged Nuisance Caused by the Crystal Palace Gas-Works.—It was reported to the Lewisham Borough Council on Wednesday that the Council's Solicitor had taken proceedings, under the 52nd section of the Public Health (London) Act, 1891, against the Crystal Palace District Gas Company, in relation to a nuisance arising from the Rivers Pool and Ravensbourne, in consequence, as alleged, of their being charged with petroleum from the Company's works.

ASSOCIATION OF MUNICIPAL CORPORATIONS.

Municipal Audit—Corporation Loans—The Promotion of Bills.

The Autumn Meeting of the Association was held at Westminster on Wednesday—Sir A. K. Rollit, M.P., presiding.

The Chairman, in opening the proceedings, referred to the Borough Funds Bill passed by the Government last session, and said that it was really an Act embodying their own Bill, which he thought greatly impressed itself on the opinion of the House of Commons. With regard to the question of the law of valuation, there was one part of it which was still unsatisfactory—that which dealt with the valuation, or rather the non-valuation, of Government properties in many boroughs. A great improvement had been made in bringing the valuation of Government properties up to date, and so reducing the general burden of the ratepayers. The principle governing this valuation, however, still existed; and he hoped that something further would be done. He congratulated the Association on the fact that, as the result of their efforts, the Housing of the Working Classes Bill of last session had been passed. If the new Act did not do all they desired, it at least increased the length of the borrowing term from 60 to 80 years; and what had been accomplished might have the effect of enabling lower rents to be charged, and therefore the poorer class of ratepayer to be more adequately provided for. He also congratulated the meeting on the passing of the County Courts Bill, whereby the jurisdiction of these tribunals in matters of civil justice had been doubled—from claims of £50 to those of £100. The measure also struck at some of the evils connected with the administration of the law which had demanded reform, including the costs and delay of litigation, which so much impeded the course of the local administration of justice. Having alluded to the education and fiscal questions, the Chairman touched on the question of municipal trading, on which a resolution was to be moved, and said that so far the Association had no reason to be disappointed with what had happened. The municipalities were not afraid of the light that might be thrown on their proceedings. The more that was shed upon their action, the better it would be both for the Municipal Councils and the State.

Mr. E. O. Smith (the Town Clerk of Birmingham) called attention to the report of the Municipal Trading Committee, and moved that it should be referred to the Council of the Association for consideration. He said the municipal corporations of the country had no reason to be dissatisfied with the report of the Committee, and whether or not all the recommendations made were practicable was for the future to decide. It almost echoed the opinions which he and others in their name laid before the Committee. The opponents of municipal trading made a great point of the desirability of a Government audit by the Auditors of the Local Government Board; and the officials of that department naturally supported them. He did his best to show the undesirability and inadequacy of such an audit. He did not attempt to defend the present system, which was a mere survival of the state of things that existed in 1835, when even companies' accounts were generally audited by amateurs—which system, in his opinion, ought to have been amended by the Act of 1882. But, on the other hand, he submitted that the Local Government audit was no remedy, and that as regards commercial undertakings conducted by corporations, it was absolutely ridiculous. He supported the appointment of properly qualified accountants by all corporations, with every facility for the publication of accounts and the report of the auditors, but with no power of surcharge. He gave his reasons, and called special attention to the power of any ratepayer to challenge illegal expenditure by an application to the King's Bench Division, under section 141 of the Municipal Corporations Act, 1882. This was the proper remedy for any serious illegality; and it was a summary and inexpensive application. With regard to the larger question, he predicted that their opponents would be equally defeated. The policy of Parliament during the last fifty years was not likely to be revoked. Every case of municipal trading in the future would be considered upon its merits; and he did not anticipate that capitalists or promoters, or even "The Times" newspaper, would ever be asked to form syndicates to acquire the great trading undertakings of their corporations. Indeed, they did not want to possess all their undertakings; they only wanted those which were profitable. He did not think that even the ingenuity of the book advertiser of "The Times" could produce a prospectus showing any prospect of a dividend on the great Welsh water scheme of Birmingham. They wished to take the cream and leave the skim-milk. This was not fair. He had never been a rabid municipalizer, and had often opposed what he called "wild-cat" schemes; but there were certain monopolies that ought, if possible, to be taken out of the hands of private enterprise in the interests of the community. It was because he believed that these undertakings had been wisely acquired by corporations in the past, and had been conducted and administered in the best interests, and greatly to the advantage of the citizens and burgesses of the country, that he moved his resolution.

Mr. W. J. Jeeves (the Town Clerk of Leeds), in seconding the motion, said it had been asserted that the municipal corporations of the country were so afraid of inquiry that they had been using backstairs influence to prevent the re-appointment of the Municipal Trading Committee. This he denied. On the contrary, they desired the utmost publicity of their affairs and criticism of them. This was the attitude they had always taken. The greater the publicity and the inquiry, the more would they be pleased. In so far as the report of the Committee urged a change which should provide for a more complete inquiry into municipal accounts, there was no doubt that municipalities desired it; and they could not reiterate this too often.

The motion was carried unanimously.

Mr. Lethbridge (Battersea) drew attention to the surcharges made by the Local Government Board Auditor and other financial restrictions placed upon Metropolitan Borough Councils, and moved—"That it be referred to the Council to promote legislation in the next session of Parliament to place Metropolitan Borough Councils in an equivalent position to that of the Provincial Corporations."

The motion was adopted.

Mr. J. H. Ellis (the Town Clerk of Plymouth) moved that the Association should reafirm the following resolution: "That, in the judgment of the Council, the power to borrow for the purposes of the Sanitary Acts contained in the Public Health Act, 1875, should be available to the full extent of two years' assessable value, and should not be curtailed by the exercise of the power to borrow under any other Acts; and that advantage should be taken of the first suitable opportunity to secure such an amendment of the law as will enable a sanitary authority to borrow for the purpose of any of their undertakings, without regard to the relation its capital indebtedness under the Sanitary Acts may bear to the assessable value of its district. That a copy of this resolution be sent to the Local Government Board and the Board of Trade, with a respectful request to the President of the Local Government Board to introduce a Bill into Parliament to give full effect thereto."

The Chairman moved, as an addition, that the President of the Local Government Board should be asked to receive a deputation on this and other subjects approved by the Council.

The motion, with the addition, was carried.

Mr. H. Brevitt (the Town Clerk of Wolverhampton) moved the following rasolution: "That, with the view of saving expense in the promotion of Bills, of reducing their length, and of insuring uniformity in their provisions, a respectful request be made to His Majesty's Government to take action on the lines of the recommendations contained in the special report of the Police and Sanitary Committee (1903), and of the report of the Select Committee on Private Business (1902), by the introduction in the next session of Parliament of a 'Local Authorities' Clause Bill,' and of a Bill collating the general public health legislation of England and Wales up to date. That a copy of this resolution be sent by the Secretary to the President of the Local Government Board."

The motion was carried, and the matter referred to the Council for them to take action thereon.

Resolutions on several other subjects were passed.

PARLIAMENTARY COMMITTEE ON MUNICIPAL TRADING.

Portions of the Evidence Abstracted.

Seventh Day—July 13.

Mr. J. M. Fells, of the Industrial Freedom League.

The whole of this sitting was taken up in hearing the evidence volunteered by Mr. J. M. Fells, a Consulting Accountant, and member of the Council of the Industrial Freedom League. Dealing first of all with the financial aspect of municipal trading, witness said he considered that the comparison which was sometimes made between the loans raised to carry on municipal undertakings and the capital belonging to an individual or a company for carrying on a similar undertaking was fallacious. The results of trading with money that was borrowed on the security of the rates, could not, of course, be compared with those of trading with one's own capital, as was the case with joint-stock companies or any voluntary association of persons. The debts of a local authority were very often alluded to as their capital; but they appeared to him to be no more capital than the National Debt could be considered the capital of the country. It seemed to him that the real comparison should be between redeemable debentures raised by a company for carrying on their work and the debts of local authorities, because the debentures had to be repaid or refunded in the same way as the debts of local authorities might have to be. But the share capital of a company had not to be repaid. If an undertaking was unsuccessful, the share capital was lost, and there was no debt remaining to be paid to those who provided the money. There was a certain distinction even as regarded the comparison with debentures; for in a company they were secured on the particular undertaking in which the investment was made, but with regard to the local debt, the security was on the total assessable value and the whole of the rates of the district. In other words, the security was unlimited in the sense that the assessment could be increased as well as the rates in order to meet the debt of the municipality. He did not think there could be any comparison between the sinking fund of a municipality and the sums set aside for depreciation in the case of a company. Depreciation represented wear and tear of plant and machinery, and so on, and went on whether provision was made for it or not. It was, in point of fact, a charge upon the ordinary cost of working or receipts. It was capital that was worn out daily, weekly, or yearly, as the case might be; while a sinking fund, on the other hand, was practically a provision for the redemption of liabilities, and in this sense could not be compared with depreciation in any shape or form. Of course, the value of the thing redeemed might have altered entirely before the period of redemption; and unless it was kept up by maintenance and renewals, there might be practically no value whatever left by the time the sinking fund was paid off. In Scotland, the difference between depreciation and sinking fund was recognized; but in England depreciation was very often used as a synonym for sinking fund. It was suggested by the Local Loans Committee last year that it should be more or less obligatory to provide suitable depreciation in making up the accounts of local authorities. He thought the periods allowed by the Local Government Board for the repayment of loans were very full. No doubt they always tried to keep on safe ground; but there was always great pressure put upon them to extend the time as much as possible.

Asked what he had to say on the question of obtaining an allowance for wear and tear for income-tax purposes, witness replied that the mode adopted by many of the authorities, of considering their sinking fund as equivalent to depreciation, meant that they should be unable—and he thought doubtless they were unable—to obtain, in making up their profits, an allowance from the income-tax people on account of wear and tear. Wear and tear depreciation was a charge on the profits before any income-tax assessment could be made; but a sinking fund instalment would not be a deduction for that purpose. Mr. Powell-Williams inquired whether witness was aware that

the Income-Tax Commissioners were raising difficulties in relation to the reduction of an allowance for wear and tear before the net result of the trading was arrived at. Witness said he knew that the Commissioners endeavoured to reap as much income-tax as they could; but, as a matter of fact, the provision for wear and tear was passed by Parliament, was generally insisted upon by traders, and in his experience was generally obtained. He was aware of cases in which the Commissioners had refused to allow the amount claimed in respect of wear and tear; but he knew of no instance which had yet been decided in the Courts in which depreciation had not been allowed as a fair charge in making up income-tax returns. The allowance of depreciation in respect of buildings depended upon whether there was practically a charge in the accounts for the repair and renewal of them; but the Commissioners allowed for depreciation of machinery.

Mr. Fells said he thought it would be possible for the Local Government Board from time to time, in sanctioning loans, to lay down the condition that depreciation should be charged in the accounts, in accordance with last year's report of the Committee on the Repayment of Loans by Local Authorities. The portion of the report to which he referred was as follows: "The Committee recommend that power should be given to the sanctioning authority to make it a condition of their sanction that provision should be made for the probable annual average cost of repairs during the currency of the loan. The amount of such necessary provision should be fixed by the authority, and should depend upon the character of the purpose for which the loan is required and the method by which it is to be repaid." Further on they said: "Some of the witnesses who have given evidence on behalf of the larger corporations have assured the Committee that a repairs or depreciation fund is provided by them in respect of most of their undertakings; but the return obtained by Sir Henry Fowler in 1899 showed that over an average of five years the average annual contribution to such funds, in respect of the debts which are called in the return reproductive debts, only amounted to one-tenth of 1 per cent." He pointed out that Sir Henry Fowler's second return (for the four years 1898-1902) showed a slight improvement; the amount provided for depreciation having increased to one-fifth of 1 per cent.

Witness next cited instances of municipalities who had set aside sums for depreciation. Bristol provided a small amount, which, however, was not arrived at on any fixed basis; Stafford set aside 1 per cent. on capital outlay; Halifax had no fixed basis; Huddersfield had an available surplus set apart for depreciation and contingencies; and Leeds and Sunderland had no fixed basis. There had been a good many assertions lately—though he thought that there were at the moment no figures to prove it—that the £2,250,000 invested by the London Borough Councils showed no profit, or would show a loss if depreciation were included. But, of course, these undertakings were only in their early stages; and perhaps it was somewhat unfair to draw any general conclusion with regard to them. He would also point out that in Blackburn the accounts on March 25, 1902, appeared to show a surplus of assets of some £561,000. The professional Auditors, in their report, stated, as regarded the year's increase: "In arriving at the above increase of £26,717, the loss during the year on the gas-works undertaking, £7428, is not taken into account, as it has been charged to the repairs and renewals account. The balance at debit of this account, which has been increased during the year from £1535 to £14,349, is treated in the accounts of the gas-works undertaking, and consequently in the aggregate balance-sheet, as an asset." They added: "In justification of this course we are informed, and it would appear from the published accounts of the gas-works undertaking, that capital expenditure in excess of that sum has during several years been charged to the repairs and renewals account." So that here the Auditors had called attention to the point. Mr. Powell-Williams said it appeared from the statement made that on former occasions the Corporation had made certain charges to revenue which possibly they might have made to capital; and that what was now proposed was to go back upon this, and take into capital something that had been charged to revenue in previous years. He asked witness whether he considered it a legitimate thing that a corporation, having in former years made a charge either to capital or revenue, should in an emergency go back upon their decision. Witness said it was very difficult to answer this as a general question. Of course, one could carry it to such a point that one might practically so arrange the books of account from year to year that one would never get anything that would be at all solid or reliable. He was afraid, therefore, that he could not answer it as a general question. Mr. Powell-Williams: "If you were auditing the accounts of a public company, where the Directors had deliberately five years ago made a certain charge to revenue which possibly they might find reason to charge to capital, would you think it a legitimate thing for them to go back upon that transaction in order to relieve the revenue account of a subsequent year, and charge to capital what five years ago they charged to revenue?" Witness: "In the case of a public company, they are under this consideration: Shareholders are essentially a changeable body, and vary from year to year; and it might not be proper to alter five years afterwards an account which had been passed by the shareholders previously. Dividends and all sorts of things might have been paid on it." Mr. Powell-Williams: "As an accountant, should you regard such a transaction as legitimate?" Witness: "Broadly speaking, I think it would be an improper arrangement, not at all desirable, and one which, however carried out, ought to be reported to the shareholders or ratepayers at the time." He added that he instanced the Blackburn case as showing practically that repairs and renewals were not considered absolutely as a charge against receipts—a charge against revenue. Of course, if it were allowable to take up the figures in an account of a previous year in order to make a different account in the current year, this would render it impossible for ratepayers to understand what their proper financial position was at any time. The great point was to make the accounts represent as accurately as possible to the ratepayers what was the position at the moment. If they went back six years and altered the accounts, it destroyed all calculations,

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 205.

Issue.	Share.	When ex-Dividend.	Dividend or Interest & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	18½—19½*	–½	5 7 8
100,000	10	,,	7½	Do. 7 p.c.	12½—13½*	..	5 11 1
200,000	5	May 14	6½	Bombay, Ltd. . . .	5½—6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
380,000	Stk.	Aug. 13	12	Brentford Consolidated	230—235	..	5 2 2
300,000	,,	,,	9	Do. New . . .	173—178	..	5 1 1
50,000	,,	,,	5	Do. 5 p.c. Pref. .	130—135	..	3 14 1
206,250	,,	June 11	4	Do. 4 p.c. Deb. .	105—110	..	3 12 9
220,000	Stk.	Sept. 11	10⅝	Brighton & Hove Orig.	207—212	..	5 1 5
246,320	,,	,,	7⅛	Do. A. Ord. Stk. .	145—150	..	5 3 4
460,000	20	Oct. 15	10	British.	38—39*	..	5 2 7
100,000	Stk.	Aug. 13	6	Bromley, Ord. 5 p.c. .	115—120	..	5 0 0
165,700	,,	,,	4½	Do. do. 3½ p.c. .	88—93	..	4 16 9
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd.	1½—10⅝*	..	6 10 3
250,000	Stk.	June 26	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 10	8½	Cagliari, Ltd. . . .	21—24	..	6 17 6
100,000	10	June 11	10	Cape Town & Dis., Ltd.	14½—15½	..	6 9 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Aug. 27	5⅝	Commercial 4 p.c. Stk.	105—108	..	4 16 3
503,750	,,	,,	5	Do. 3½ p.c. do.	90—102	..	4 18 0
442,947	,,	June 11	3	Do. 3 p.c. Deb. do.	87—90	..	3 6 8
800,000	Stk.	June 11	7	Continental Union, Ltd.	120—125	..	5 12 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	135—140	..	5 0 0
575,000	Stk.	Aug. 27	5⅛	Crystal Palace Ord. 5 p.c.	112—117	..	4 11 1
60,000	,,	,,	5	Do. 5 p.c. Pref. .	118—123	..	4 1 4
112,533	,,	July 10	5	Do. 5 p.c. Deb. Stk.	135—138	..	3 12 6
486,090	10	July 29	10½	European, Ltd. . . .	17½—18½	..	5 13 6
354,060	10	,,	10½	Do. £7 10s. paid	12½—13½	..	5 16 8
15,243,200	Stk.	Aug. 13	4⅝	Gas- 4 p.c. Ord. . .	85—87	–4	5 1 2
2,600,000	,,	,,	3½	light 3½ p.c. max. .	86—88	..	3 19 7
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	104—107	..	3 14 9
4,193,975	,,	June 11	3	Coke 3 p.c. Con. Deb.	87—89	..	3 7 5
258,740	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	90—95	..	5 5 3
70,000	10	Oct. 15	8	Hongkong & China, Ltd.	15—16*	..	5 0 0
3,800,000	Stk.	May 14	10	Imperial Continental .	200—205	..	4 17 7
473,600	Stk.	Aug. 13	3½	Do. 3½ p.c. Deb. Red.	99—102	..	3 8 7
165,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.	113—118	..	5 1 8
561,000	Stk.	,,	10	Liverpool United A .	214—216	..	4 12 7
718,100	,,	,,	7	Do. do. B .	163—165	..	4 4 10
306,083	,,	June 26	4	Do. do. Deb. Stk.	110—112	..	3 11 5
75,000	5	June 11	5	Malta & Medn., Ltd. .	4¼—4¾	..	5 5 3
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	101—105	..	4 15 3
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	June 11	3½	Monte Video, Ltd. . .	9—10	..	7 0 0
1,515,892	Stk.	Aug. 13	4½	Newc'tle & G'tesh'd Con.	103¾—104½	..	4 6 2
376,855	Stk.	July 3	3½	Do. 3½ p.c. Deb.	96½—97½	–½	3 11 10
300,000	Stk.	May 14	8	Oriental, Ltd. . . .	140—145	..	5 10 4
600,000	5	Sept. 30	7	Ottoman, Ltd. . . .	5—6	..	5 16 8

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	June 26	6½	Ply'mth & St'house 5 p.c	123—128	..	4 15 8
851,070	10	Oct. 15	7	River Plate Ord. . .	11—11½*	..	6 1 9
300,000	Stk.	June 26	4	Do. 4 p.c. Deb. .	94—96	..	4 3 4
250,000	10	Sept. 30	8	San Paulo, Ltd. . . .	11—12	..	6 13 4
135,000	Stk.	Sept. 11	10	Sheffield A	238—240	+2	4 3 4
209,984	,,	,,	10	Do. B	238—240	+2	4 3 4
523,498	,,	,,	10	Do. C	238—240	+2	4 3 4
116,106	Stk.	Sept. 30	5	Shrewsbury Ord. 5 p.c.	103—112	..	4 9 3
6,150,000	Stk.	Aug. 13	5⅜	South Met., 4 p.c. Ord.	117—120	..	4 8 10
1,780,000	,,	July 10	3	Do. 3 p.c. Deb. . .	87—90	..	3 6 8
380,940	Stk.	May 14	5	Southampton Ord. . .	105—110	..	4 10 11
87,950	,,	July 10	4	Do. 4 p.c. Deb.	102—105	..	3 16 2
120,000	Stk.	Aug. 27	6	Tottenham and Edmonton A. 5 p.c. B. 3½ p.c.	115—120 / 95—100	..	5 0 0 / 4 10 0
313,020	,,	,,	4½				
182,380	10	June 11	8	Tuscan, Ltd.	8—9	..	8 17 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	58—100	..	5 0 0
737,142	Stk.	Aug. 13	5	West Ham, 5 p.c. Ord.	93—98	..	5 2 0
				WATER COMPANIES.			
780,776	Stk.	June 26	11⅛	Chelsea, Ord. . . .	300—310	..	3 14 2
150,000	,,	,,	5	Do. 5 p.c. Pref. .	145—148	–2	3 7 7
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	132—137	..	3 5 8
175,785	,,	Sept. 30	4½	Do. 4½ p.c. Deb. .	135—140	..	3 4 4
1,720,560	Stk.	Oct. 15	8	East London, Ord. . .	200—210*	..	3 16 2
654,740	,,	June 11	4½	Do. 4½ p.c. Deb. .	138—143	..	3 2 11
1,282,943	,,	,,	3	Do. 3 p.c. Deb. .	92—95	..	3 3 2
700,000	50	June 11	10	Grand 10 p.c. max..	120—125	–2	4 0 0
310,000	Stk.	Sept. 30	4	Junction 4 p.c. Deb..	120—125	..	3 4 0
708,000	Stk.	Aug. 13	10	Kent	275—285	..	3 10 2
1,043,800	100	June 26	11	Lambeth, 10 p.c. max..	290—295	..	3 14 7
406,200	100	,,	8½	Do. 7½ p.c. max..	210—220	..	3 17 3
350,000	Stk.	Sept. 30	4	Do. 4 p.c. Deb..	120—125	..	3 4 0
500,000	100	Aug. 13	12⅛	New River, New Shares	380—390	–5	3 5 7
1,000,000	Stk.	July 29	4	Do. 4 p.c. Deb..	121—124	..	3 4 6
902,300	Stk.	June 11	7½	South- Ord. . . .	215—225	–7½	3 6 8
126,500	100	,,	7½	wark 7½ p.c. max.	200—210	–10	3 11 5
489,200	Stk.	,,	5	and 5 p.c. Pref. .	145—150	..	3 6 8
1,019,585	,,	Oct. 15	4	Vauxhall 4 p.c. A Deb.	120—125*	..	3 4 0
1,155,066	Stk.	June 11	10	West Middlesex. . .	265—275	..	3 12 9
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .	133—138	..	3 5 3
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb. .	92—95	..	3 3 2

* Ex div.

and make it exceedingly difficult to form any calculation whatever as to the value of the accounts when presented. If the figures quoted were taken, and one payment was treated as a set-off against the other, he would even then consider it to be an undesirable mode of keeping accounts. Each year must be considered by itself.

Turning to Bradford, witness said the accounts of the Corporation for the year ended March 31, 1901, were comprised in some 650 pages of a large quarto volume. While the amount owing to the bankers was apparently some £67,225 on the gas fund, there was £13,700 handed over from this fund to the city fund in relief of rates. According to Sir Henry Fowler's two returns, comprising the period of nine years from 1893 to 1902, there had been nothing placed to depreciation on the gas-works, on which there had been a total capital outlay of £823,328; nor did any amount appear to have been placed to depreciation since the sum of £8000 in 1891. According to the first return (1893-1898), there had been applied in aid of rates an average annual amount of £7060; and according to the second return (1898-1902), an average annual amount of £2297. But judging from the report for the year ending March 25, 1902, there was really a loss of about £11,658 on the gas-works. He believed that no payment was made this year in relief of rates. Then in Bradford they practically showed an excess of assets over liabilities on their various undertakings. The total of these assets amounted to £2,443,398. The system of valuation applied to tramcars and electrical machinery seemed to be to value them at the amount they cost—writing off nothing for depreciation. Contemporaneously, the rates had increased in the five years from 6s. to 7s. 8d. The profits on rents and trading undertakings, arrived at by the methods he had referred to, which in 1898-9 amounted to 3¼d. in the pound, had declined to 1 1/2d. in 1902-3.

As regarded the transfer from one department to another of items of expenditure or receipts and balances, witness said he thought it was exceedingly desirable that regulations should be laid down prescribing the extent to which (if at all) such transfers should be made. Considerable evidence on this point was given before the Committee who sat in 1900; and the Lord Provost of Glasgow insisted upon it very strongly, urging that there would be a grave loss of stimulus if the manager of one department knew that any loss upon his branch would be made up by the transfer of a surplus from another. Witness said he did not know if the practice was carried on to any large extent; but it was sufficiently prevalent to make comparisons between different places and different years exceedingly unsatisfactory. For instance, Bradford transferred £5000 a year for four years from the water fund in order to initiate a municipal insurance fund. Then in Manchester he believed they had been accustomed to take £50,000 in relief of the rates from the gas undertaking. They did not take it in one particular year, he supposed owing to the price of coal, or something of that kind; and they raised the price 3d. per 1000 cubic feet in order to obtain it. In Bristol, the loss for the year 1901-2 on electricity supply was £996; and this was made up partly by withdrawing £491 from the reserve fund and £218 from depreciation account. This was all stated in the accounts; but attention was not particularly drawn to it. There was no distinct statement of the fact that there had been a transfer. In Paisley, in 1901-2, the profit on the gas supply was £3831, of which £2686 was carried to deficiencies on the electric lighting account. In answer to Sir J. Stirling-Maxwell, witness said he could not at the moment think of any other reason for treating the accounts in this way than to make them come out better. Of course, there might be some other reason known to the authorities at Paisley; but what it was he did not know. He simply stated facts, without attributing any motives. The transaction was indicated in the accounts; and any ratepayer who took sufficient interest to go into the matter could turn it up the same as he had done.

Other cases of a similar nature were subsequently cited by witness. At Buxton, a profit of £728 on gas supply was carried partly to electricity revenue account on which there was a loss; while at Dewsbury a loss on water-works account was made up from the profits on the gas supply. In Huddersfield, a loss on tramways was made up partly by transferring £5000 from depreciation, and partly by an increase of 3d. in the pound on the rates; and at Rotherham a loss on water-works and markets was made up from profits on the gas-works. It was pointed out to witness that the loss on the tramways at Huddersfield was due to a very serious accident, which entailed heavy claims for damages; but he said that whatever the facts might be, his contention broadly was that they could not make up the loss of one year practically by re-appropriating the profits of past years. This was the principle which, it seemed to him, was involved in the cases he had quoted. Each trading department should be considered a business by itself; and the profit and loss of the individual department should be shown quite separately from the profits and losses of other departments.

The next question taken up was the allocation of profits in relief of the rates; and in reference to this, witness said it seemed to him that the Committee or sanctioning authorities should lay down rules as to whether profits earned by municipal undertakings were to be applied in reduction of the rates or whether they were to be devoted to cheapening and improving the service. Of course, the system of applying profits in relief of the rates became municipal commercialism pure and simple. It differed in no way, in respect of the result, from similar undertakings carried on by private enterprise. If a municipality had no competitor, they could fix prices or rates high enough to ensure a substantial profit. Provision also should equally be made, or rather rules should be prescribed, as to whether the loss on a trading operation was to be a charge on the rates, or whether it was to be met by increasing the charge for the service or commodity. There had been many cases before Parliament in recent years in which it had been practically prescribed that if there was a loss on the undertaking, the authority should charge it to the consumers. Witness quoted the Bermondsey clause as an instance of this, as well as the terms of several Tramways Acts. Even as long ago as 1885, he said, when the Stalybridge gas undertaking was being taken over, there was a provision made that the public should not lose the benefit of the Act by which they shared

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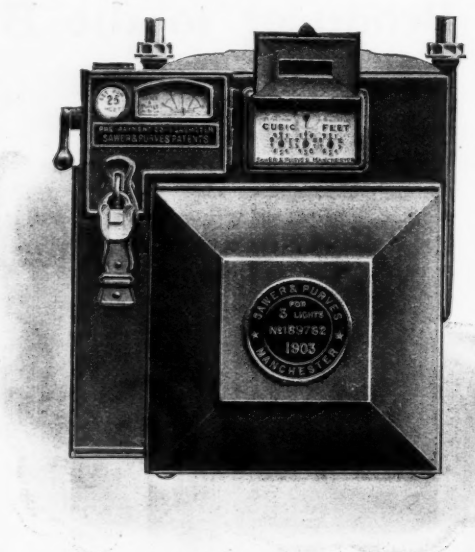
(through reductions in price) in the prosperity of the Company. In this case, he thought, a division had to be made—half the profit was to be taken to a reserve or suspense account, and the remainder was to be applied in reduction of the price. The profits should, in the first place at any rate, go towards reducing the price of the commodity; otherwise the matter became a form of indirect taxation. In the event of a loss on the working of any municipal undertaking which had to be met out of the rates, he would suggest that the amount which the ratepayer had to pay in connection with it should be entered on the demand note, which might also serve as a useful means of conveying information to the citizens as to the financial result of all trading operations in which they were, *nolens volens*, engaged. The result in the matter of profit or loss in regard to each undertaking could be shown on the demand note, so that ratepayers would have the information set plainly before them, and would not have to search volumes of accounts.

With regard to the raising and paying off of loans, witness said the mode adopted by many local authorities, of continual repayments and borrowings, was an exceedingly wasteful and extravagant one. There were, of course, every time negotiations and law costs, and many other things which added to the expense. In 1898, the professional Auditor of the City of Worcester prepared a statement to show the result of 32 years' transactions with reference to the raising of funds by small loans, and what the state of affairs would have been if the Corporation had paid the sum required for the improvements out of the rates levied. The statement contained the whole of the loans, large and small, for the period named, with the exception of one of £61,028 raised for electric lighting; and it showed that the total loss to the ratepayers by the system adopted, from 1866 to 1897, was £117,948. Had they met all the accounts of the year out of the rates for the year (always excepting the electric lighting loan), they would not have had to raise these loans, and to pay interest on them. Save in two or three cases, the total amount to be raised for each year would not have been greater than under the prevailing system they had had to pay. The difference was really the difference between the cash system and the credit system. Of course, the method he suggested would not apply to large undertakings, but only to what might be called the recurrence of small loans. The following extract from a speech made by Mr. Milner, the President of the Institute of Municipal Treasurers and Accountants, would, witness said, illustrate the point he wished to make: "Many persons are of opinion, and I join with them, that it is not wise to pursue a course of continual borrowing and re-borrowing for such works as street paving and draining; but as the works grow old and require renewing, this should be done by annual proportions and paid for in cash, thereby saving the addition to the cost of interest. The matter seems simple enough to work out. Say a town has 30 miles of sewers, and the average life is 30 years, one-thirtieth part thereof should be renewed yearly; and if the life of the paving be 10, 15, or 20 years, one-tenth, one-fifteenth, or one-twentieth should be done yearly, in accordance with the requirements of the case."

As to the borrowing powers of local authorities, it was desirable that these should have some definite relation to the rateable values. It was a point as to whether such powers should not practically be confined to those authorized by the Public Health Act, 1875. Of course, municipalities obtained special powers over and above this Act; and very often, in addition, they secured large overdrafts from their bankers. The proportion of debt to rateable value varied widely in different places. Witness handed in a table giving particulars in regard to many towns. This showed, for instance, that in Halifax, Blackburn, and Wigan the debt exceeded the rateable value $5\frac{3}{4}$ times, in Birmingham $4\frac{3}{8}$ times, in London nearly $1\frac{1}{8}$ times, in Manchester $5\frac{1}{2}$ times, in Middlesbrough $4\frac{1}{4}$ times, in Stockton 5 times, and in Warrington $3\frac{1}{4}$ times. The consent of the ratepayers ought to be obtained to the raising of money for trading purposes; and the matter ought not to be decided by a mere majority, but by a proportionate one. The Borough Funds Act had just been amended, and withdrew from an individual ratepayer the opportunity of protesting against these sums being raised—it being stipulated that a hundred ratepayers, or one-twentieth of the electors, must join in any opposition to the promotion of a Bill. He certainly thought that some scheme of proportionate representation ought to be given to joint-stock companies. Speaking from recollection, he thought that at present no body could have more than twelve votes; and, of course, joint-stock companies were very heavily rated, so that obviously, in any particular district, twelve votes would seem to be altogether an inadequate representation. Therefore schemes were carried by those whose rateable value was small, but whose voting power was exceedingly great. Facilities for raising loans had a tendency to cause people to turn to them instead of utilizing the rates. There was very little difficulty in obtaining a loan, because the Local Government Board were so crowded with work that they either had to more or less scamp it or let it stand over. They did investigate the matter of loans a good deal; but considerable pressure was brought to bear upon them, and, of course, it was excessively difficult, once a loan had been granted to one body for a particular purpose, to refuse it to another municipality for a like object.

In answer to Sir George Bartley, witness said it was a fact that, in the case of many corporations, a great number of the large ratepayers had no vote at all. He did not think they could by any possibility get more than twelve votes, even if they were paying 50 or 60 per cent. of the rates. In towns like Crewe, and in industrial villages, the rates paid by joint-stock companies were very large; and they got very little in return. On the other hand, the compound householder paid rates only in his rent; and in this case there was a divorce, practically, of the whole principle of taxation and representation. Human nature being what it was, in the present stage of evolution, people had not quite the same incentive to deal with the strictest accuracy with the affairs of other people as they had with their own. The best way therefore would be for the accounts to be so published that every ratepayer could clearly understand what was going on. The auditor, too, should not be dependent for his tenure of office on the corporation whose accounts he audited. He should always

S&P



THE "POSITIVE" DRY METER

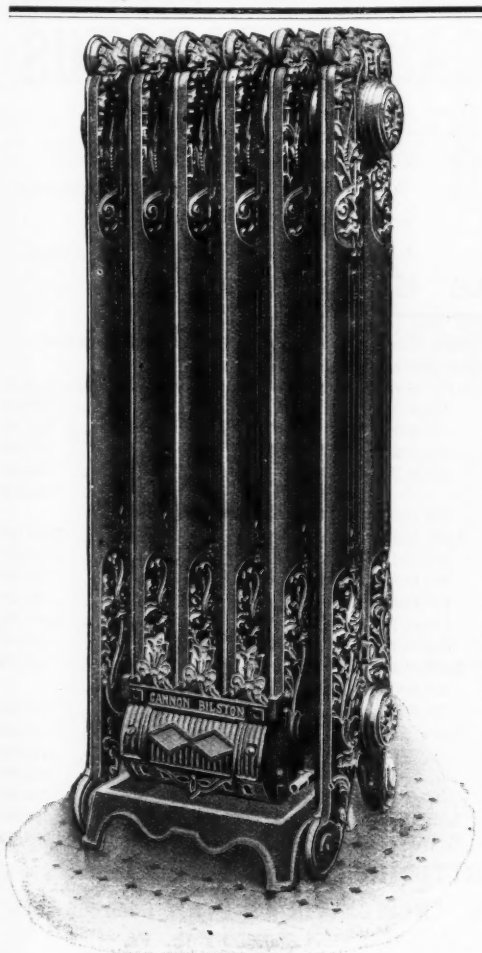
be appointed by the corporation, but should have to a certain extent security of tenure through the Local Government Board, by his dismissal being made subject to their consent. He did not think it was desirable that municipal accounts should be audited by the Local Government Board, because very few of their auditors had any proper training. In addition to this, the Local Government Board auditors had not the large general acquaintance with commerce and commercial accounts which would be valuable to a corporation.

Questioned by Sir James Woodhouse as to the object for which the Industrial Freedom League came into existence, witness explained that it had been founded to collect and diffuse information as to the economic business effects of municipal trading. The League were not opposed to municipal enterprise; but they considered that the function of a corporation was to govern, and not to trade. A large number of the members, however, were not opposed to municipalities owning water-works, on the ground that this was a measure of sanitation and health. They drew the line at any operation involving risk, or in the carrying on of which the methods employed were liable to supersession. Water-works involved very little, if any, risk; and they could hardly be considered a trading operation. This, however, was not the case with gas, which was liable to competition from a variety of quarters. All the so-called municipal trading profits were, in fact, a form of indirect taxation. He had illustrated this by a reference to Manchester, where, he believed, they raised £50,000 in relief of the rates by adding 3d. per 1000 cubic feet to the price of gas. This, of course, was making the users of the gas contribute to the rates; and if the price was raised for this specific purpose, it was hardly fair to call the sum realized a profit—it was simply making the gas consumers find the money, and not the ratepayers. Of course, they might also have a case in which a small number of people were using a thing at a loss, and then the rates having to make good the deficiency. Reverting to the question of depreciation, witness said he regarded this as a proper subject for investigation; and a general rule should be laid down for dealing with the matter. He did not say that any provision should be made for depreciation which did not arise. In the case of a town hall, for instance, the rate of depreciation would be very small; but there must be something under this head, however well the building was maintained or repaired. At the end of fifty years it could not be in so good a condition as when it was first built. It was therefore the duty of the ratepayers to hand over the building then in a full state of repair, *plus* a depreciation fund to put that "full state of repair" into a condition equivalent to the pristine state of the town hall. Mr. Powell-Williams remarked that it was a pretty strong order to say that the ratepayers of to-day should maintain the building year by year, and at the end of fifty years, in addition to all this, they should have accumulated a depreciation fund, so that they might make over the building, fully repaired and possessing also this fund, free of all cost to the ratepayers of that time. Witness, however, said he thought it was reasonable that the ratepayers should always have the assets for which they had spent the money.

WATER-METERS IN THE UNITED STATES.

In the course of a paper read by Mr. E. W. Bemis, the Superintendent of the Cleveland (U.S.A.) Water-Works, at the joint session of the Central States Water-Works Association and the Association of the Boards of Public Service of Ohio recently held at Dayton, he gave some particulars in regard to the use of water-meters in his city. He said that during the 26 years prior to 1902 the meter system had been gradually introduced upon substantially all business premises, with the exception of some small stores and saloons. There were in use 3640 meters and elevator indicators; but nevertheless the consumption of water had increased from 111 gallons per head per day in 1891 to 169 gallons in 1901; while the consumption of water from 1 a.m. to 4 a.m. was more than half as great as the rate during the two or three hours of maximum use in the morning and afternoon. Less than 500 houses were metered; and it was determined to meter as rapidly as possible the entire 53,000 unmetered services. During 1902, there were 7700 meters installed, and up to Sept. 1 last there were 8300 more. There were now 19,300, while the Water Department was setting at the rate of upwards of 12,000 a year, at an average cost for all styles of setting of $14 for each §-inch meter. This included the cost of the Trident meter and its setting. If the setting was near the kerb, the meter was usually set in a cement pipe, though wherever practicable it was placed in the basements, at an average cost of $10·60, including the meter. The result of all this was, he said, as follows: The increase in the consumption of water was 22·5 per cent. from 1891 to 1894, the same from 1894 to 1897, and 38·7 per cent. from 1897 to 1900. But during the first eight months of 1903 there was an actual decrease of 6·6 per cent. below the consumption for the first eight months of 1900; and there were indications that the whole year 1903 would show more than 7 per cent. decline from the pumping of 1900, despite the very large growth of business and population. The consumption per head had fallen from 169 gallons in 1901 to less than 145 gallons this year, and would continue to go down steadily while the remaining 36,000 services were being metered during the next three years. The great saving effected by the meters had been that they had obviated the necessity for large extensions of pumps, buildings, feeder mains, &c., which would otherwise have been required. This saving far more than counterbalanced the cost of the meters. Mr. Bemis added that there did not appear to be any marked saving in operating expenses, because the reduction in cost at the pumping-station and in house inspection was counterbalanced by a necessary increase in the office force, meter readers, &c. The paper closed with an account of the methods of meter setting, and of the successful measures taken to popularize the system in Cleveland.

The statistics published by the Lawrence (Mass.) Water Board on the consumption in the past year include some interesting figures on metering. There are 4886 meters on domestic services, and 438 on



THE "CANNON"

'CORONATION' SAFETY

(Patent No. 18,889, 1903.)

CONDENSING RADIATOR.

Perfect Condensation. No Flue required.
Positively no Odour. No Danger.
Powerful Heat. No Waste.

MADE IN 3 SIZES.

Our New Season's List comprises an unparalleled series of New Patterns.

CANNON IRON FOUNDRIES, LTD.,
GAS-STOVE DEPARTMENT,
DEEPFIELDS, near BILSTON, STAFFS.
LONDON OFFICE AND SHOW-ROOM:
BATH HOUSE, 57-60, HOLBORN VIADUCT, E.C.

manufacturing supplies, together equal to 83·4 per cent. of all services. Through them 567,162,000 gallons of water were supplied to 57,195 persons of the total connected population of 63,318; yielding a revenue of $90,100. The total unmetered consumption amounted to 683,118,270 gallons, with a revenue of $14,632, and included water used for fire protection, street sprinkling, flushing and other municipal purposes, and leaks, besides that supplied to takers on the assessment basis. Meters were set in the connections of eighteen business places suspected of extravagance. At the end of 22 days it was found that the water used was worth $3·79 per day more at meter rates than would have been paid on the assessment basis; being equivalent to $1364 per annum additional revenue. When the meters were read three months later, the average consumption throughout the city had been reduced 33 per cent.

Water-meters and cleanliness are incompatible, according to Mayor Hays, of Pittsburgh, who regrets that meters are destined to be used extensively in that city. He fears that their introduction will prevent the people from keeping "either their property or themselves as clean as they do now, when water is plentiful." Referring to this matter, the "Engineering Record" says: "His Honour need not worry. People who sweep their walks with a hose instead of a broom or allow water to run continuously from fixtures in order to satisfy their notions concerning the flushing of drains, may have these habits of misguided cleanliness suddenly checked. For most people, however, it will be different. The city pays a certain amount of money to build and operate water-works to deliver water along the streets; and it is easy to ascertain the cost of this water per 1000 gallons. It also costs a certain small sum to read meters or to inspect fixtures, and to attend to the book-keeping of the water purveyor's office. The sum of these charges, with a reasonable addition for contingencies, is the cost of the supply to the consumer. This cost can be assessed in two ways: When determined by meter, there is a minimum rate established which will allow all the water actually needed for cleanly people who are not wasteful. For extravagance or waste in the use of water, it is only right that payment should be made according to the amount required in excess of the liberal allowance on which the minimum is based. This excess is measured by the meter. If the meter system is not adopted, some plan of guessing at the amount of water drawn by each consumer must be introduced, and inspectors must be kept at work looking for leaks. The meter system is more expensive to introduce; but it is less open to the objection due to frequent rummaging of inspectors through a house, and it is probably less expensive in maintenance, than a really thorough system of inspection. The meter system is accurate and certain, while the system of flat rates with constant inspection is so uncertain as to deserve little support. From the standpoint of cleanliness, there can be no choice between the two systems; but from the standpoint of impartiality and justness, the meter system is far superior to the older method of charging for water by a flat rate based on the number of fixtures in the house or the feet frontage of the property."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Ardrossan has now to be added to the list of towns, already a considerable one, in which new gas-works have been erected within the past few years. Old works are in many places so limited in space that it is found impossible to get into them the plant which would economically produce the increased quantity of gas now required; and it has been found to be more profitable to build an entirely new works than to overcrowd the old. In such cases, the initial outlay is greater; but the economy is apparent when working results are attained. The town is happily situated where it is recognized in time that the way to save is to spend now, instead of persisting in carrying on, under disadvantages, in the old place. In Ardrossan, there is every appearance of the Corporation having moved their works before the time of certain loss has arrived. The town is not a large one—the population is only a little over 6coo—but there is a great influx of summer visitors, who require to be catered for. Cheap and good gas is not the least of the attractions of a seaside residence for town dwellers, who are apt to make invidious comparisons with the services they have at home. The Corporation have, therefore, recognized it as an imperative necessity that if they are to go forward, they should have as good a gas supply as it is possible to obtain.

The new works erected are really a credit to them. They are isolated, commodious, and in every way suitable for a town of the size. Located in neat and architecturally proportionate structures, the plant is up-to-date, without being too ambitious for the size of the place. At the opening on Thursday, Provost Young complimented Mr. A. Gillespie, of Glasgow, the Engineer of the works, upon his successful production—an observation which a walk round showed to be well deserved. In a town like Ardrossan, there is great difficulty in selecting a site for gas-works, because the sea view counts for much. They have, giving effect to this, placed the new works on the inland side of the town. This is in every way quite satisfactory, except that the works are about 40 feet above the level at which they would have been if placed on the shore. This necessitates an increased pressure; but it is not anticipated that there will be trouble on this score. Most excellent railway facilities have been obtained, which must prove of great benefit to the undertaking. It is only an accidental circumstance that the Corporation are erecting a refuse destructor upon one end of the ground which they acquired for the gas-works. We hear sometimes of electric light undertakings and refuse destructors being linked together; but in this instance the two Corporation departments are to be kept entirely independent.

It is not often that such a case of neglect of a gas undertaking can be made out as is established against the Corporation of Falkirk by

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN.	1,250,000	ST. CATHERINES (Remodelled) .	250,000	ACCRINGTON.	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT. . .	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA. . . .	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN. . . .	500,000	YORK (Second Contract) . .	750,000
WINDSOR ST., BIRMINGHAM (Second Contract) . . .	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract) .	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.). . . .	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil) . .	125,000
LINDSAY (Remodelled) . .	25,000	CRYSTAL PALACE DISTRICT .	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.) . . .	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract).	250,000	ENSCHEDE (HOLLAND) . .	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled) . .	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract) . .	750,000
		KINGSTON-ON-THAMES . .	1,750,000	TORONTO (Fourth Contract) .	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract) . . . . . 1,800,000 Cub. Ft.

two reports which have been submitted to the Gas Committee by Mr. W. M'Crae, the Manager. In the first, dated Sept. 15, he said:

Having been requested by Convener Russell to state my opinion as to the producing power, &c., of your works, I beg to lay before you the following particulars. At present there are 64 modern retorts with regenerative settings, capable of producing about 525,000 cubic feet of gas per 24 hours. There are also 42 retorts heated on the older and more expensive method of open fires. From the information which I have received as to the results obtained previously from these retorts, I do not consider that they will produce much more than about 189,000 cubic feet of gas per 24 hours, bringing out a total production of 714,000 cubic feet per 24 hours, or almost 5,000,000 cubic feet per week of seven days. I find that the maximum daily consumption last December amounted to 787,400 cubic feet; but this was when supplying the town and districts at a very inadequate pressure of 17-10ths at the works. This only gives at some of the outlying points 4-10ths, which pressure is quite useless for lighting. Had the pressure been, say, 25-10ths at the works, I estimate that the quantity of gas delivered would have been increased by about 20 per cent., or to about 945,000 cubic feet. I would take the liberty to point out that, by section 21 of your Act of 1894, it is prescribed "that from midnight till sunset the pressure supplied to any consumer shall not be less than 6-10ths of an inch, and from sunset to midnight not less than 8-10ths of an inch," which is higher than could be supplied during any part of the lighting season last year. From the beginning of this financial year up till the end of August, the consumption of gas shows a substantial increase as compared with the same period last year; and if such increase is maintained during the winter months, it is quite certain that the town will require to be supplied at as low, if not lower, pressure than was the case last year. At the present time, all the coals which give the largest volume of gas are being carefully stored, so as to be available when most gas is required; and I can assure you that nothing will be left undone at the gas-works that will tend to make the lighting of the town as satisfactory as the circumstances will permit.

In his second report, dated Oct. 12, Mr. M'Crae stated:

As instructed by you at your meeting of Sept. 15, to report as to introducing additional retorts into your gas-works, also as to the time of putting the present retorts into action, I beg to lay before you the following particulars: Although it would be possible, as far as space is concerned, to increase the number of retorts in the present works, I consider that it would be very injudicious to do so, for the following reasons: The present coal-stores being much too small for our requirements, it would be quite impossible to give off any portion of same for an extension of retorts. The only way, then, an extension could be got would be to erect a new bench, with settings of eight retorts in each arch, on the side of the present small bench. The retort-house is also very small; and were this carried out, I greatly fear that the temperature of the house would be raised to such a degree, when all the retorts were in action, that it would be impossible for the men to work in it; and there would also be a great congestion in carrying on the work. Further, the station meter is only capable of correctly registering 30,000 cubic feet of gas per hour; and therefore, if the quantity of gas were increased, a new meter would have to be erected. The condensers are not large enough to satisfactorily deal with the quantity of gas produced by the present retorts; and therefore they would require to be enlarged if more gas were to be produced. The purifiers last winter were passing 50 per cent. more gas than they are constructed for. It is quite impossible for them to purify a larger quantity; and there is no space whereon to enlarge them or to erect others. No augmentation can now be made of any part of the apparatus that can be of any assistance to us during the coming winter. I have carefully looked into the matter of the time of putting the retorts into action, and think that the reason that last winter the pressure was kept down while some of the retorts were still out of action was to keep the pressure as uniform as possible, as well as to conserve the greatest power for the greatest demand. It is quite true that the retorts could all be put in action as the demand increases; but bearing in mind the large increased quantity of gas at present being used, I think a point would very soon be reached when it would be imperative to reduce the pressure in order to maintain even a short supply. The difference from the light obtained from the high pressure, as compared with that obtained from the reduced pressure, would be so very marked, that I think it would result in an even greater dissatisfaction throughout the lighting district than would be the case if a similar method to that adopted last year were acted upon, and a uniform reduced pressure applied throughout the winter.

Mr. H. Russell, in moving the adoption of the reports, said he would like to draw the attention of the Council to them, as that might be his last opportunity of doing so. The reports showed that they would be short of the requirements of the district this winter by something like 325,000 cubic feet of gas per day. They would also see, in the matter of the purification of the gas, that last year the purifiers had to pass 50 per cent. more gas than they were built for; and that this year they would be face to face with something like 60 per cent. more than they were made to pass. The reports were adopted.

A special meeting of the Town Council has been called, at which it is proposed to decide upon a site for new gas-works. Communications have, it is intimated, been received from the Railway Company, which, it is anticipated, will result in an almost unanimous decision in favour of the Thornhill site. This is the site which, after it had been adopted, the electors were last year frightened into rejecting. The successful party then will consequently have, as their sole satisfaction, the reflection that they have delayed by a year a very much needed work.

It was explained to the Gas Committee of the Dundee Town Council on Tuesday that the peculiar incident which I mentioned last week as having occurred in connection with the city gas supply on the evening of Monday, the 12th inst., was due to the man in charge having neglected to slow down the pumps when the retorts went off, in consequence of which the seal of the hydraulic main was broken and air was drawn in. It was remitted to a Committee to inquire into the matter and to report.

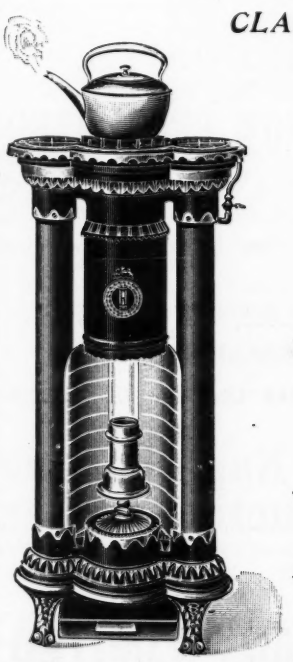
In these days, when so much is heard about the encouragement of home industries and the keenness of foreign competition, it may be of interest to note that this week the Cleaning and Lighting Committee of the Edinburgh Town Council discussed three types of incandescent gas-lamps, which they require in connection with a tardy extension of this method of lighting the streets. Two of these lamps were tendered by British manufacturers, at a cost of 42s. and 39s. respectively. The third was by a German firm, and was offered for 32s. The German lamp was said to be considerably in advance of the other two in illuminating power; and the Committee agreed to recommend its adoption. About 300 lamps will be required.

PURE HEAT.

WITHOUT SMOKE OR SMELL.

CLARK'S PATENT HYGIENIC

"SYPHON" STOVES



IMPROVED COMBINED

HEATING AND BOILING STOVE.

The Hot-Plate on Top, being under separate control, can be used during Summer Months.

Adopted by the Leading Gas Companies.

WRITE FOR CATALOGUE OF NEW DESIGNS FOR SEASON, 1903-4.

S. CLARK & CO., Patentees and Makers, Compton Works, Canonbury Road, Highbury, London, N., and "Syphon" Works, Islington, N.
Show-Rooms: Bath House, 58, Holborn Viaduct, E.C. Telegrams: "Syphon Stoves, London."

THE BEST STOVES

TO LET

ON HIRE

OR SELL.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 24.

Sulphate of Ammonia.

Throughout the week the market has been quiet. On the one hand, makers hold that the strike at the shale mines in Scotland must result in a substantial shrinkage in the production of sulphate of ammonia, and that higher prices must ensue; on the other hand, buyers maintain that the companies have sufficient stocks of shale to keep them going for some time, and that in any case the strike has already been discounted in the sulphate market. Hence, quotations remain £12 5s. per ton f.o.b. Hull, and £12 7s. 6d. per ton f.o.b. Liverpool and Leith; and there is not much disposition to purchase at the moment. In the forward position, there has been good inquiry, and £12 10s. per ton f.o.b. Hull is reported to have been paid for January-June delivery. In Scotland, makers, being uncertain as to the duration of the strike, are very firm, and no important business has transpired.

Nitrate of Soda.

This article is quiet in all positions. The closing spot prices are 9s. 9d. per cwt. for ordinary quality, and 10s. 3d. for refined.

LONDON, *Oct.* 23.

Tar Products.

Business in the various articles has been fairly good during the past week, with the exception of pitch, which is in an unsatisfactory state. There is a good demand for prompt delivery; but so far as forward is concerned, there is an absolute dearth of business. Very low prices are being named on the Continent; but even these do not tempt consumers to purchase, as they believe in a still further depression. There are no stocks on hand at present; and it is difficult to see why there should be any anxiety on the part of dealers to reduce prices. Benzol is very firm; and 90 per cent. is being freely sold at 10d. In some instances makers ask 10½d. for immediate delivery. In 50-90 per cent., there is also a better demand; and makers now ask 8d. for forward delivery. At the moment, however, consumers are holding off the market. In solvent, there is a slightly improved demand for export; while for heavy naphthas, with a high flashing point, there is a very strong demand for both prompt and forward delivery. Crude carbolic continues to sell freely at 1s. 6d. In fact, a sale is reported at 1s. 6½d. for November-March, f.o.b. London. Crystals are quiet. It is reported that the German makers are accepting very low prices. The demand for creosote continues very good for both export and home consumption; and prices have slightly advanced all round. In anthracene, there is really nothing doing. Some small parcels are offering at from 1¾d. to 2d. per unit, according to quality; but consumers do not take much interest in the article.

The average values during the week were: Tar, 23s. 6d. to 30s. 6d. Pitch, London, 50s. 6d. to 51s.; east coast, 49s. to 49s. 6d.; west coast, 48s. 6d. to 49s. Benzol, 90 per cent., 10d.; 50-90 per cent., 7½d. to 8d. Toluol, 7d. to 7½d. Crude naphtha, 3½d.; solvent naphtha, 8d. to 8½d.; heavy naphtha, 9½d. to 10½d. Creosote, London, 1⅞d. to 1 1/16d.; North, 1⅜d. to 1½d. Heavy oils, 2⅛d. to 2¼d. Carbolic acid, 60 per cent., 1s. 6d. Refined naphthalene, £5 to £8. Salts, 25s. to 27s. 6d. Anthracene, "A" quality, 1¾d. to 1⅞d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The demand for forward delivery is very strong indeed; but there is not much doing for prompt. The Gaslight and Coke Company quote £12 10s. for prompt and £12 15s. forward, while the South Metropolitan Company ask £12 8s. 9d. for October and £12 10s. for November-December. In Hull, the demand continues fairly good for immediate shipment; and further business is reported at £12 5s. In Liverpool, there is not much doing; the nominal price being £12 6s. 3d. In Leith, makers still ask £12 7s. 6d.; but there are no sales at over £12 6s. 3d. for prompt, though an offer of £12 10s. for January-June is reported to have been declined.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The partial resumption here and there of full operations at cotton mills in this district, and the prospects that as further shipments of cotton come forward this will become more general, is giving a rather more hopeful tone to the coal trade. Otherwise the situation remains without any very material change or improvement. The demand for house-fire coals continues limited, and below the average for the time of the year. Prices are only just about steady at late rates, with occasional special surplus lots coming on the market for prompt clearance at low-cut prices. Best Wigan Arley coals are still quoted about 13s. 6d. to 14s. 6d. per ton at the pit, medium qualities 11s. and 11s. 6d. to 12s. 6d., and common house-fire sorts from 9s. 6d. to 10s. 6d. There is still no improvement in the demand for the lower descriptions of round coal used for steam and forge purposes. From outside districts there are special lots offering at low figures, which tend to weaken the market; and although there is no quoted change so far as Lancashire collieries are concerned, low prices have to be taken to secure business. The commoner sorts of steam and forge coals can be bought from 7s. 9d. to 8s. and 8s. 3d. per ton at the pit, with some of the better qualities quoted 8s. 6d. to 8s. 9d. The demand for shipment also continues indifferent; and with plentiful supplies of steam coal offering at the ports, buyers can purchase in quantity at low figures. The commoner steam coals are obtainable at from 8s. 9d. to 9s. per ton, with ordinary quotations about 9s. 6d. to 9s. 9d. delivered at the Garston Docks or the high-level, Liverpool. Common slacks average 4s. up to 4s. 6d. per ton, medium 5s. to 5s. 6d., and best slacks 6s. 3d. to 6s. 9d.

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Northern Coal Trade.

There is a weaker tone in the North-eastern coal trade, which is due partly to the practical closing of the Baltic trade, and partly to the fact that there is a very considerable diminution in the demand for fuel in some of the industries of the North. There is, in consequence, a weakness in the prices for some of the kinds of fuel; and this sympathetically affects other qualities. In steam coals, best Northumbrians are down to about 9s. 10d. per ton f.o.b. Second-class steams are 8s. 9d. per ton, and steam smalls about 5s. Gas coals now show a decided increase in the demand; but the supply is adequate, and deliveries are being fully kept up. Prices of Durham gas coals now vary from 8s. 3d. to 8s. 10½d. per ton f.o.b. for occasional cargoes; and contracts are much about these prices, unless for periods of some duration, when they are easier. Gas coke is very irregular, and values vary so much that quotation of price is difficult.

Scotch Coal Trade.

There cannot be said to be any change of circumstances as yet, and no brighter prospect for the coalowner. The demand is sufficient to keep the collieries about fully employed; but there is no buoyancy in trade. The prices quoted are: Main 7s. 9d. to 8s. per ton f.o.b. Glasgow, ell 8s. 6d. to 9s. 9d., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 229,299 tons—an increase of 4520 tons upon the previous week, but a decrease upon the corresponding week of last year of 24,149 tons. For the year to date, the total shipments have been 8,887,450 tons—an increase of 243,499 tons upon the same period of last year.

Reinstatement of Roads in South London.—A long-standing difficulty existing between the Lewisham Borough Council and the South Metropolitan Gas Company, in regard to the making good of roads broken up, was removed last Wednesday, when an agreement was entered into to the following effect: The Council will, with all convenient speed, after the ground has been duly filled in by the Company, repair, make good, and restore the surface of all trenches. The Company are to pay to the Council once a quarter the cost of such repairs, according to the schedule of prices approved by the Council on Oct. 9, 1901, and July 29, 1903. The Company accept responsibility for all trenches opened by them, and indemnify the Council against all liability in respect thereof; such indemnification to cease when the Council commence the work of repair or 48 hours after notice to repair, whichever may happen first. That in any case where, in the opinion of the Borough Surveyor, a trench has not been properly filled in, the Surveyor may remove so much of the soil as he considers necessary, and replace it with hard core at the cost of the Company; the Borough Surveyor to give notice of every such case to the Company's Engineer. The Council entered into a similar agreement with the Lambeth Water Company.

Cheap Electrical Power at Grimsby.—The Grimsby Corporation Electricity Committee have adopted a scheme for the supply of current for power purposes during the daytime at 1d. per unit. At present the whole of the plant is not employed throughout the day, so that more current could be generated at very little additional expense. Consumers who adopt the new arrangement will have their current cut off as soon as the evening load comes on.

New Water Scheme for Skipton.—The Skipton Urban District Council, at a special meeting held on Thursday, had submitted to them a report from the Water Committee concerning the scheme for a new and additional water supply for the town. A report was also read from the Engineer (Mr. G. H. Hill, M.Inst.C.E.), and another from Professor Boyd Dawkins, F.R.S., who had viewed the place selected for the building of a reservoir. A long discussion followed the reading of the reports, which ultimately resulted in congratulations being tendered to the Water Committee and the Surveyor and Water-Works Manager, for the admirable scheme that had been laid before the Council. It is stated that the capacity of the proposed new reservoir will be something like 140 million gallons. The site is within 2½ miles of Skiption.

A New Reservoir for Ipswich.—In 1900, the Ipswich Water Committee instructed their Engineer (Mr. Hamlet Roberts) to prepare plans, &c., for a new service reservoir on land which had been acquired by the Corporation immediately behind the existing reservoirs. The plans were prepared; and, at the request of the Council, the Committee submitted them to Mr. James Mansergh, who reported that Mr. Roberts's design was a good one. The work was therefore put in hand; and last Friday week the reservoir was opened in the presence of a number of members of the Corporation and friends, who were entertained to luncheon by Mr. W. Orford White, the Chairman of the Water Committee. The site occupies 2 acres, including the embankments; and the area of the top of the reservoir is 1¼ acres. The roof is supported by 375 cast-iron columns.

Strike of Gas Workers in Barcelona.—According to a Reuter's telegram sent from Barcelona on Friday, the city was in complete darkness the previous evening, owing to a strike at the gas-works. It was stated that the Government had informed the strikers that it would show them no mercy, because they had disregarded the law obliging them to give twelve days' notice before going out. The streets were being patrolled by the Civil Guard, who were endeavouring to prevent accidents arising from the darkness. The Government had ordered a Workmen's Society formed of employees of the Gas Company to be prosecuted; and some strikers had been arrested for intimidation. A certain quantity of gas had been stored beforehand, in order to provide against a possible strike; but the telegram states the strikers let it all escape. Most of the shops and some of the theatres found it necessary to close; while in other places, business was carried on by the aid of candles. Those manufacturers who use the ordinary gas supply as motive power have, of course, had to shut down their works.

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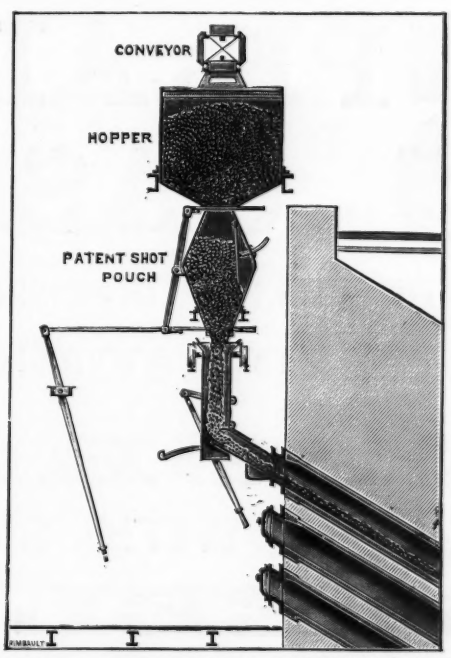

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Another Fatal Acetylene Gas Explosion.—An explosion of acetylene gas, which resulted in the death of James Colquhoun Chisholm, master painter, residing at Langside, Glasgow, occurred on Thursday. Chisholm was engaged in making acetylene gas in his business premises at Govanhill; and the explosion was brought about by his applying a light to a tap attached to the generator. He was struck on the head, and instantly killed.

Lignite Gas for Catalonia.—According to "Revista Minera," Señor Olano, the proprietor of the lignite mines of Berga, is about to construct large gas-works to supply the industrial districts of Barcelona. The cost of coal at the mines is about the same as in Staffordshire, while the value of gas is stated to be double or triple what it is in the locality to be served. The initial cost for mains will, no doubt, be greater than in England. The mines are now prepared for an output of 200,000 metric tons per annum.

Extension of the Wenlock Gas-Works.—The Wenlock Town Council, having applied to the Local Government Board for sanction to borrow £1400 for an extension of the gas-works, Mr. R. H. Bucknell held an inquiry into the matter on Friday. It was stated that the outstanding loans amounted to £6000. The Council required the money to put the gas-works in good order, which would be the means of increasing the consumption. If they did not obtain the loan, the cost would have to come out of the rates.

Metropolitan Water Board.—In a previous issue of the "JOURNAL," it was announced that Mr. H. Clarke and Mr. H. P. Harris had resigned their seats as representatives of the London County Council on the Metropolitan Water Board. Mr. Clarke, however, in deference to the expressed wishes of his colleagues on that body, subsequently consented to place his services at their disposal. Accordingly, the Council re-elected him at their meeting on Tuesday; and chose Lieut.-Col. A. Rotton to replace Mr. Harris.

The Actions against the Huddersfield Corporation.—At a meeting of the Huddersfield Corporation on Wednesday, the General Purposes Committee stated that they had considered a long report from the late Town Clerk (Mr. F. C. Lloyd) on the penalties imposed upon the Corporation for the non-discharge of compensation water into streams for the use of millowners, to which reference has already been made in the "JOURNAL." The total penalties claimed in all the actions was £9520, and the sum paid to the plaintiffs was £4150. In the Huddersfield Water Acts, 1869 and 1890, no qualification was made in the section providing for penalties beyond the vague provision that occupiers were to be "affected" by the neglect. "When it is remembered," continues the report, "that £50,000 was paid as purchase money for the water, the absurdity of the position is manifest." By the Bill of 1902, the water-works undertaking is protected, except so far as being liable to a single penalty for default, instead of being subject to cumulative penalties. The report was adopted.

Explosion at an Oil-Gas Works.—Owing to the bursting of a hydrocarbon supply pipe, an explosion of gas occurred last week in the oil-gas making department of the Glasgow and South-Western Railway at Glasgow. The windows of a number of tenements in the neighbourhood were shattered, and a man named Jackson, who was on duty at the time, was badly burned. The plant was much damaged.

Development and Lighting of Ainsdale.—Mr. Charles J. Weld-Blundell, Lord of the Manor, has commenced a costly scheme for the development and lighting of Ainsdale seawards. Gas-mains have been laid along what is known as Shore Road to a new esplanade on the sea-front, and arrangements are made in the scheme for lighting it. Fine drives and gardens, which will be specially lighted by gas, will extend from Ainsdale to Birkdale, and also to Freshfield and Formby; so that the promenade, when completed and lighted, will be one of the finest and most extensive in the kingdom. The incandescent system of lighting will most likely be adopted.

Reducing Leakage at Perth (W.A.).—Particulars to hand from Australia show that Mr. W. G. Quicke, the Engineer of the Perth (W.A.) Gas-Works, is making excellent headway in the reduction of the unaccounted-for gas; the loss last August having been only 6·43 per cent., as compared with 15·64 per cent. in the same month of the preceding year. Satisfactory as this is, however, it is by no means the only good feature of the working statement, for the quantity of gas sold increased by 8·37 per cent. The number of Lucas lamps fixed was 52, making a total of 173 for 6½ months. Of those fitted during August, 29 were of 700-candle power, 15 of 400-candle power, and 8 of 200-candle power.

Vyrnwy Water for Wallasey.—Some three years ago, the authorities at Wallasey resolved to make arrangements with Liverpool for the introduction of Vyrnwy water into the district. The pipe-line has now been completed; and a week or two ago the valves between the terminus of the Liverpool line and the beginning of the pipes in the Wallasey district were formally opened. Mr. Richard Steel, as the oldest member of the Wallasey District Council, the Chairman of the Finance Committee, and the originator of the Vyrnwy scheme, presided over the ceremony, which began by the Lord Mayor of Liverpool (Mr. W. W. Rutherford, M.P.) authorizing Mr. B. Swanwick, the Chairman of the Wallasey Committee, to turn on the water. Alderman Burgess, the Chairman of the Liverpool Water Committee, then asked Mr. J. R. Lloyd, the Vice-Chairman of the Wallasey Committee, to open the valve at the Wallasey side of the meters, and said he was glad to find that the cost of laying the pipe-line would be something like £30,000 less than the estimate of £150,000. The party then drove to Gorse Hill, New Brighton, and inspected the new reservoir, which is made to contain 4½ million gallons of water. The main pipe-line is 21 inches in diameter, with a capacity of 2½ million gallons a day; but the present scheme involves the taking of half-a-million gallons daily, at 6d. per 1000 gallons. Subsequently the company were entertained to lunch at the Victoria Hotel, by Mr. Steel, who presided.

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Margate Water Supply.—At their last meeting, the Margate Town Council sanctioned the contruction of a concrete reservoir, to hold a million gallons, at Flete, on land to be purchased for the purpose. The cost of the work, inclusive of the land, is estimated at £11,588. This is an addition to the Wingham works, lately opened.

The Recent Floods at Ilford.—During the recent severe floods, the Manager of the Ilford Gas-Works (Mr. A. A. Johnston) passed through a very anxious time, having a vivid recollection of the trouble he experienced in June from the "plague of waters." He was fearful lest the bank should not prove strong enough to withstand the pressure of the great volume of water which had collected; and so measures were taken to strengthen the earthwork. Labourers were engaged all day wheeling ballast to raise the bank; and this was supplemented by scores of bags of ballast piled on the top. Lamps were burning all night; and Mr. Johnston and his assistants kept anxious watch. Fortunately the pressure had somewhat abated next morning, and the anxiety of the watchers was gradually relieved as the waters slowly but surely subsided.

The Directors of the Monte Video Gas Company, Limited, have declared an interim dividend of 6s. per share, less income-tax, for the half year ended the 30th of June.

Messrs. Gibbons Bros., Limited, and Messrs. B. Gibbons, jun., Limited, have removed from No. 128 to more commodious offices at Nos. 142 and 143, Palace Chambers, Westminster, S.W.

Messrs. Joseph Taylor and Co., of Bolton, have in hand detachable ammonia and acid pipe plate lead saturators for the East Grinstead Gas Company and the Gravesend and Milton Gas Company.

The Water Committee of the Bradford Corporation recommend the acceptance of the tender of Mr. John Best, of Edinburgh, for the construction of a reservoir at Angram, Pateley Bridge, for £365,492.

The London County Council last Tuesday decided to accept the offer of the South Metropolitan Gas Company to maintain and renew the incandescent mantles and to light the new lamps on the south pontoon at Woolwich Ferry at a cost of £10 3s. per quarter.

Among the latest catalogues received is one from the Imperial Stove Company, of Leamington Spa, which contains illustrations and particulars of the gas cooking and heating apparatus manufactured by them. The firm are making a speciality of large gas and steam stoves for hotels, restaurants, and public institutions.

The Gas and Electric Committee of the Belfast Corporation have concluded their purchases of coal, and divided the order between the Wigan Coal and Iron Company, Limited, the Eveson Coal and Coke Company, Limited, the Hulton Colliery Company, and Messrs. Duncan, Kelly, and Co., at an average price of 14s. 2½d. per ton.

The Castle Douglas Gas Company have placed the order with Messrs. R. Dempster and Sons, Limited, of Elland, for a steel tank 53 ft. 6 in. diameter by 16 ft. 6 in. deep, and a single-lift gasholder. The contract includes excavations and foundations. It was let on the 25th of August, and the work will be finished next month.

The Hebden Bridge and Mytholmroyd Gas Board have advanced, unsolicited, the salary of the Manager (Mr. Ernest J. Wellens) by £25 per annum from the 1st prox., with a further increase of like amount from the beginning of next year. As Mr. Wellens has only occupied his position for six months, this spontaneous acknowledgment of his services must be highly gratifying.

"The Times" has been requested to state that at a meeting of the Dominion Oil Company, Limited, held at Chatham, Ontario, on the 1st inst., it was decided that the Company should be wound up, and that an inquiry should be instituted, in consultation with the Attorney-General of the Province, as to the origin of the concern, in respect of which fraud is alleged on the part of certain persons.

It is not often that parliamentary proceedings cost very much less than promoters and their agents estimate. This, however, is the case with the Bill introduced by the Oldham Corporation last session to enable them to carry out their Dean Head water scheme. The agents received £1300 on account, and the bill sent in is for only £922. A balance of £378 will consequently come back to the Corporation.

The working of coal in the United Kingdom still shows progress; but the advance in its production has proceeded of late years at a slackened rate. In 1893, the output was 164,325,795 tons, valued at £55,809,808. Last year the figures were 227,095,042 tons, of the value of £93,521,407. In 1900, the output was about 2 million tons less than 1902, but the value was £121,653,596; the next year the tonnage was about 8 millions less than last year, while the value was £102,486,552.

At the meeting of the Westminster City Council on Thursday, it was decided to inform the Board of Trade that the Council were of opinion that they should be furnished with further powers, in order to exercise greater control over the breaking up of the streets within their jurisdiction by the electricity supply companies, and that a clause should be inserted in all Orders granted by the Board making it obligatory upon such companies to supply light or power to public buildings or for public lighting in their district at rates not greater than the lowest rates charged to any of their consumers.

We have received from Messrs. Emmott and Co., Limited, of Manchester, the "Mechanical World" Pocket Diary and Year Book for 1904. This is the seventeenth year of publication; and the present issue contains a considerable amount of fresh matter, among which may be mentioned new tables of stresses on bolts, steam and gas pipe fittings, bevel and spur gear formulæ, &c. These should add to the general utility of this handy little book of reference, the contents of which have been revised generally and brought up to date. The tables and other matter occupy 294 pages; and they are followed by a diary arranged for a week on a page.

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WORKING Foreman seeks Situation, or would Take Charge of a small Gas-Works. Thoroughly understands routine of small works. Age 33. Thirteen Years' good Reference. Abstainer.
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ENGINEER, capable of combating opposition from Electric Lighting, wanted for a Gas-Works in New South Wales, Australia. First class passage; salary £300, and House.
Address full Particulars, with photo., to No. 4112, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for medium-sized Gas-Works near Birmingham, a Handy Man to repair Tools and Machinery. Wages 7d. per hour. Preference given to a Practical Mechanic who has held similar appointment.
Apply, enclosing *copies* of Testimonials, to No. 4101, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, immediately, an Assistant METER INSPECTOR for Provincial Gas Company. Must have had previous Experience. Wages, 27s. weekly.
Apply, by letter, stating Age and full Particulars, with *copies* of Character, to No. 4113, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

REQUIRED, an Outdoor Superintendent of Public Street Lighting in London Boroughs, with knowledge of Incandescent Lighting and Maintenance, also supervision of Lamplighters and Fitters. Commencing Salary £150 per annum.
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Borough Gas-Works, Wigan.
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FOUR 8 ft. by 4 ft., with separate Valves to each, 7-inch Connections.
For Price and further Particulars, apply to ENGINEER, Gas-Works, RICKMANSWORTH.

ABOUT 40 Tons of 12-inch Cast-Iron Socketed PIPES for Sale. Each Pipe is 12 feet long; Weight, 9 to 10 cwt. Condition, nearly equal to new.
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Four PURIFIERS, 13 ft. 4 in. by 9 ft., and Centre-Valve for same.
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One Clapham's Patent "Eclipse" Slow-speed CONDENSER.
One Gwynne and Beale's Patent GAS EXHAUSTER, together with Horizontal Engine on same bed-plate, and fitted with Inlet, Outlet, and Bye-pass Valves.
One New Three-Lift GASHOLDER, 60 ft. 6 in. by 18 ft. deep each lift, on Gadd and Mason's patent principle, without Guide-Framing.
One Single-Lift GASHOLDER, 60 feet by 18 feet deep.
Also VALVES, PIPES, and CONNECTIONS.
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Capacity 4200 feet per hour, 8-inch Connections and Bye-Pass (Larger Meter being installed).
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Two (18 inch) SQUARE STATION METERS, new drums.
TOWER SCRUBBERS from 3 ft. 6 in. up to 12 feet diameter, in pairs or singly.
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Cylindrical STATION METER, with 8-inch Inlet, Outlet, and Bye-Pass Valves and Connections, 10,000 cubic feet per hour.
One ⊂ CLAY RETORT, 21 in. by 16 in. by 9 ft.
8-inch Inlet and Outlet EXHAUSTER CONNECTIONS, with Bye-Pass Complete, for Two Exhausters.
One Vertical STEAM-BOILER, 6 ft. by 2 ft. 6 in., insured to 50 lbs., with Safety-Valve complete.
One STATION GOVERNOR, with 8-inch Inlet, Outlet, and Bye-Pass Valves and Connections complete, by George Orme & Co.
One STATION GOVERNOR as above, 8-inch Connections, by Alex. Wright & Co.
All the above are in good working order.
Further Information from, and Tenders (endorsed) to
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Engineer.
Gas-Works, Swadlincote.

SPENNYMOOR AND TUDHOE GAS COMPANY.

THE Directors of the Spennymoor and Tudhoe Gas Company invite TENDERS for the Construction and Erection of a TELESCOPIC GASHOLDER on their Premises.
Plans and Specification can be seen at the Offices of the Company, Spennymoor.
Sealed Tenders, endorsed "Tenders for Gasholder," to be lodged with the undersigned, on or before Tuesday, the 3rd of November, 1903.
The lowest or any Tender not necessarily accepted.
(Signed) WM. COWLEY,
Secretary.
Gas-Works, Spennymoor,
Oct. 10, 1903.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of SILICA and FIRE-CLAY GOODS, required at their Neepsend, Effingham Street, and Grimesthorpe Stations, during the next Twelve Months.
Specifications and Forms of Tender may be had on application to the Company's Engineer, Mr. J. W. Morrison, on and after Oct. 15, 1903.
The Directors do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, marked "Tender for Fire-Clay Goods," must be delivered by post to the undersigned not later than the first post on Saturday, Oct. 31.
HANBURY THOMAS,
General Manager and Secretary.
Commercial Street, Sheffield,
Oct. 8, 1903.

CITY OF BELFAST.

CONTRACT FOR COALS.

THE Gas and Electric Committee of the Belfast Corporation invite TENDERS for a supply of 105,000 Tons of best Screened GAS COAL, to be delivered free and trimmed in Barges at Belfast Harbour, between the 1st of November, 1903, and the 31st of October, 1904.
No Tender for less than 10,000 Tons will be considered.
Monthly quantities and particulars may be obtained from the Manager of the Gas-Works.
Tenders on Office Forms, endorsed "Tender for Coal," must be delivered at my Office not later than noon on the 3rd of November, 1903.
The lowest or any Tender not necessarily accepted.
SAMUEL BLACK,
Town Clerk.

CLACTON URBAN DISTRICT COUNCIL.

THE above Council are prepared to re- ceive TENDERS for the supply and delivery of about 60 Tons of CAST-IRON PIPES and CONNECTIONS.
Copy of the Specification and Form of Tender may be obtained from the Council's Engineer, Mr. Sydney Francis, Assoc.M.Inst.M.E., Town Hall, Clacton-on-Sea.
Sealed Tenders, endorsed "Tenders for Pipes," to be delivered to the undersigned not later than noon on Tuesday, the 3rd of November, 1903.
The Council do not bind themselves to accept the lowest or any Tender.
GEO. T. LEWIS,
Clerk to the Council.
Town Hall Buildings,
Clacton-on-Sea, Oct. 19, 1903.

YEOVIL CORPORATION WATER-WORKS.
STOCKWOOD SUPPLY.

TO PIPEFOUNDERS.
CONTRACT No. 7.

THE Corporation of Yeovil are pre- pared to receive TENDERS for the making and delivery of nearly 6 miles in length of CAST-IRON SOCKET-PIPES, for the most part 9 inches internal diameter, together with certain OTHER PIPES and SPECIAL CASTINGS.
Specification and Forms of Tender may be had on payment of the sum of Two Guineas (to be returned on receipt of a *bonâ-fide* Tender), on application at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., or at the Office of the Borough Surveyor, Yeovil, on and after Monday, the 26th day of October inst., and Tenders must be delivered at my Office on or before Monday, the 9th day of November next.
The Corporation do not pledge themselves to accept the lowest or any Tender.
H. B. BATTEN,
Town Clerk.
Yeovil, October, 1903.

YEOVIL CORPORATION WATER-WORKS.
STOCKWOOD SUPPLY.

TO PIPE LAYING CONTRACTORS.
CONTRACT No. 8.

THE Corporation of Yeovil are pre- pared to receive TENDERS for the laying of nearly 6 miles of CAST-IRON SOCKET PIPES, for the most part 9 inches internal diameter.
The Specification and Drawings may be inspected, and Forms of Tender may be had on payment of the sum of Two Guineas (to be returned on receipt of a *bona-fide* Tender), on application at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., or at the Office of the Borough Surveyor, Yeovil, on and after Monday, the 26th day of October inst., and Tenders must be delivered at my Office on or before Monday, the 9th day of November next.
The Corporation do not pledge themselves to accept the lowest or other Tenders.
H. B. BATTEN,
Town Clerk.
Yeovil, October, 1903.

YORK TOWN AND BLACKWATER GAS AND COKE COMPANY, LIMITED.

ISSUE OF £2 10s. SEVEN PER CENT. "ADDITIONAL" SHARES.

SALE BY TENDER OF 1360 £2 10s. SEVEN PER CENT. "ADDITIONAL" SHARES, in pursuance of the Provisions of the York Town and Blackwater Gas Orders, 1890 and 1899.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER 1360 £2 10s. "Additional" Shares of £2 10s. each (the standard dividend on which is Seven per cent.), to be paid up in full on or before the First day of December, 1903.
Particulars and Conditions of Tender may be obtained at the Company's Office, York Town, Surrey, or of the Secretary, as under.
Sealed Tenders must be sent to the Secretary not later than Wednesday, the 11th day of November, 1903.
By Order,
SIMEON ROWE,
Secretary.
The Gas-Works, York Town, Surrey.
Oct. 17, 1903.

YORK TOWN AND BLACKWATER GAS AND COKE COMPANY, LIMITED.

ISSUE OF TWENTY-FIVE £50 DEBENTURES,
Bearing Interest at 4 per Cent. per annum.

NOTICE is Hereby Given, that the Directors of the above Company, in pursuance of the Provisions of the York Town and Blackwater Gas Orders, 1890 and 1899, have decided to issue Debentures of the Company to the extent of £1250, bearing Interest at 4 per cent. per annum, and payable half yearly.
Forms of Application, which may be obtained at the Company's Office, York Town, Surrey, or of the Secretary, as under, must be returned to me not later than Wednesday, the 11th day of November, 1903.
By Order,
SIMEON ROWE,
Secretary.
The Gas-Works, York Town, Surrey.
Oct. 17, 1903.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

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AND OF THE

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FOR THE YEAR 1902 1903.

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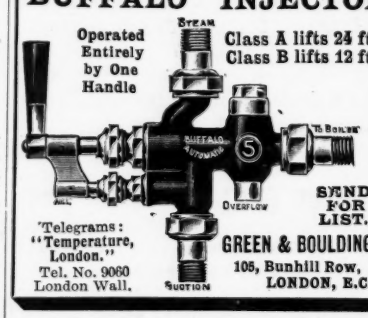

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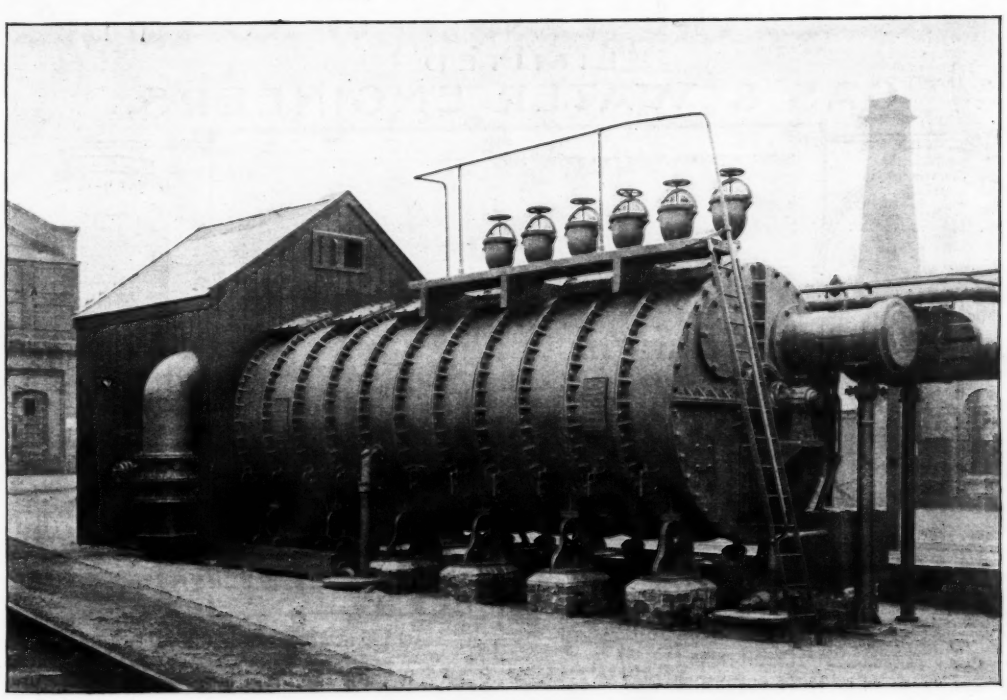

[See also p. 217.] "NEW" SCRUBBER-WASHERS. [See also p. 217.]

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Scoops supplied with or without handles, and of any dimensions or shape required

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66, BANKSIDE, LONDON, S.E. Telephone No. 565 HOP.

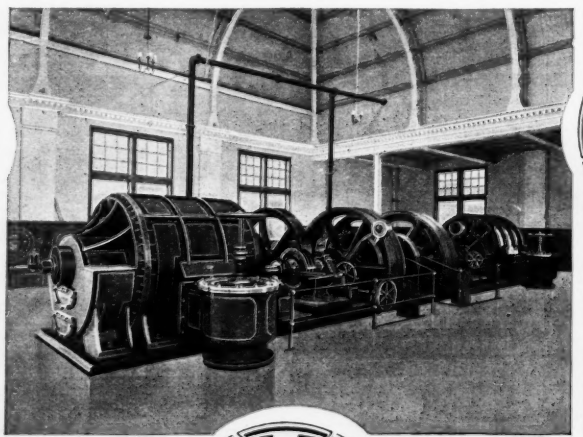
HARPER & MOORES, Limited,
STOURBRIDGE.
MANUFACTURERS OF
Inclined, Horizontal, and Segmental
GAS-RETORTS,
Fire-Bricks, Fire-Clay Lumps, and Tiles
OF EVERY DESCRIPTION.
Also Manufacturers of **Cast-Iron Retorts, Iron Mouthpieces, Pipes, and all necessaries for Gas-Works requirements.**
Telegraphic Address: "MOORES, LYE." Telephone No. 23 Lye.

JOSEPH CLIFF & SONS
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
Wortley, LEEDS.
LONDON OFFICES & DEPÔTS:
Baltic Wharf, Waterloo Bridge, S.E.
and G.N. Goods Yard,
King's Cross, N.
Liverpool: Leeds Street.
Leeds:
Queen Street.
Machine-Made Retorts
Have been made in large quantities for the last twenty years; and during the whole of that time have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
Retorts carefully Packed for Export.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

JAMES MILNE & SON, LTD:,
GAS ENGINEERS
MILTON HOUSE WORKS EDINBURGH.
LONDON. — LEEDS. — GLASGOW.

R. LAIDLAW & SON,
LIMITED
GAS & WATER ENGINEERS,

SIMON SQUARE WORKS, EDINBURGH.



6 LITTLE BUSH LANE, LONDON, E.C.

TWO EXHAUSTERS EACH TO PASS 750000' CUB. FT. PER HOUR AT 60 REVOLUTIONS PER MINUTE DRIVEN BY TWO GAS ENGINES

AND INTERMEDIATE FRICTIONAL GEARING, ERECTED AT GRANTON GAS WORKS FOR EDINBURGH & LEITH GAS COMMISSIONERS.

ALLIANCE FOUNDRY & ENGINEERING WORKS, GLASGOW.

THE RUSH FOR INVERTED GAS-BURNERS.

The visitor to the show-room of the Gaslight and Coke Company just now might perhaps imagine that he had wandered unwittingly into the topsy-turvy house at Earl's Court. For he will find there all the latest patterns in the new inverted incandescent gas-burner, which, fitted on to the ordinary household bracket, gives the appearance of the gas being upside down, which, of course, is really the case. The Manager informed a WESTMINSTER representative yesterday that the rush for these new burners was on lines quite unexpected, and the Company finds great difficulty in keeping pace with the demand for "conversion" which has suddenly set in. The public have apparently fully realized the great advantages which these new devices offer. All the bother about broken chimneys and mantle-rods is obviated, while the absence of shadows is another important feature. It is also claimed for the new invention that it has the decorative appearance of electric light at one-tenth the cost, and, further, that the gas consumption is only three cubic feet per hour. An adaptable bracket for use with the old fixture is the latest improvement in "gas upside down."—*Extract from the* WESTMINSTER GAZETTE, *Oct.* 22, 1903.

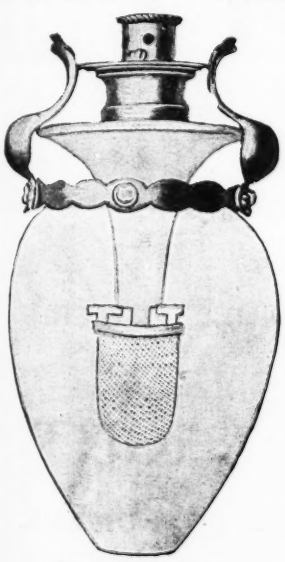
The Burners referred to in the above paragraph are supplied by

THE NEW INVERTED INCANDESCENT GAS-LAMP CO., LIMITED,

AND SHOWN IN THE ILLUSTRATIONS BELOW.

The Latest Novelty in Gas Lighting is the

PATENT INVERTED INCANDESCENT GAS-BURNERS.



One-third full size.
Price: Burner with Mantle, **6/6.**
Globes from **8d.** each.

No. 1 BURNER.

The most up-to-date and economical system of gas lighting, artistic in appearance and absolutely shadowless, and readily attached to existing fittings.

A BRILLIANT WHITE LIGHT OF 65 STANDARD CANDLE POWER.

Gas Consumption only 3 cubic feet per hour.

The decorative appearance of Electric Light at one-tenth the cost.

THE "BIJOU" BURNER

Is the nearest approach to Electric Light, and lends itself more than any other gas-burner to private house lighting, having an exceedingly pretty effect when fixed in clusters of 2, 3, or 5 lights.

20 standard candle power.

Consumption of Gas, 1 foot per hour.

One-third full size.
Price: Burner with Mantle, **4/6.** Globes from **4d.** each.

THE NEW INVERTED INCANDESCENT GAS LAMP CO., LTD.,

Only Address: 23, FARRINGDON AVENUE, E.C.

F. C. SUGDEN & Co.

CARBONIZING SPECIALISTS.

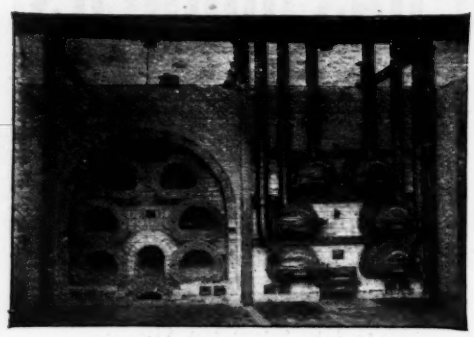


PHOTO. OF REGENERATOR SETTINGS DURING CONSTRUCTION.

REGENERATOR & GENERATOR SETTINGS

DEEP, SEMI-DEEP, AND SHALLOW.

Maximum Make per Ton and Mouthpiece.

Minimum Fuel Consumption.

NUMEROUS REPEAT ORDERS

Have been received for each of the above types of Settings.

RESULTS GUARANTEED. RETORTS RESET.

SOLE MAKERS OF **CRIPPS' PATENT CHIMNEY.**

Designs and Estimates on application. 28, EAST PARADE, **LEEDS.**

COAL TAR PRODUCTS.

Benzol, Toluol, Solvent Naphtha, Creosote Oils, Grease Oils, Carbolic Acid, Crude Creosote Salts, Granulated (Crude) Naphthalene, Sublimed Naphthalene, Anthracene, Refined Tar, Pitch, also Sulphate of Ammonia.

For Prices apply to the **SOUTH METROPOLITAN GAS COMPANY,**

Works: ORDNANCE WHARF, EAST GREENWICH, LONDON, S.E.

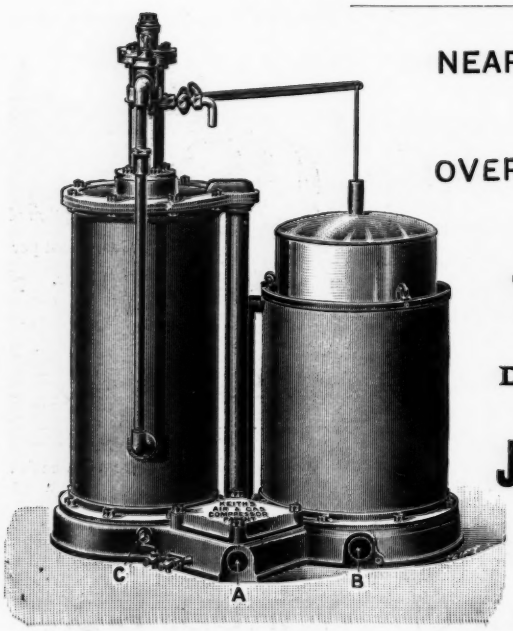
709, OLD KENT ROAD, LONDON, S.E.

Telegraphic Address: "METROGAS, LONDON."

THE

KEITH LIGHT

(Intensified Incandescent Gas.)



NEARLY **1000** INSTALLATIONS

already in use, with lighting capacity

OVER **6,000,000**—CANDLE POWER.

SEND FOR ILLUSTRATED PAMPHLETS ON

THE KEITH LIGHT

FOR

DISTRIBUTION TO LARGE CONSUMERS.

JAMES KEITH & BLACKMAN CO.,

LIMITED

27, Farringdon Avenue, LONDON, E.C.

AND MANCHESTER, GLASGOW, LEEDS, BIRMINGHAM, BRISTOL, and BELFAST.

Published Weekly

THE LUCAS LIGHT RECORDER

Price 0d

Issued in the interests of the Gas Industry and the finest high-power Gas Lamp known

No. 15.] [*Tuesday, October 27, 1903.*

Had a Copy?

Our "Experience" Series

III (*contd.*) **Strength & Quality of Light**

Mr. PHILIP L. PRICE, 21, Cannon Street, Manchester:
"All are agreed that the Lucas Light is a marvel, and Lockhart's Restaurants in this city that have been fixed are regarded without exception as the best lighted places here."

Messrs. HODGES, ROSE, AND Co., Tailors, 146, Seven Sisters Road, N:
"We consider it a splendid light, and very much better than we really expected."

Mr. L. MONK, Lewes Gas Company:
"The light obtained from gas used is perfection and really a marvellous light without aid of any forced pressure. They only require to be known to be fully appreciated."

Mr. ALEXANDER LAMB, Leyton:
"The Lucas Lamps give the most brilliant light I have ever seen indoors."

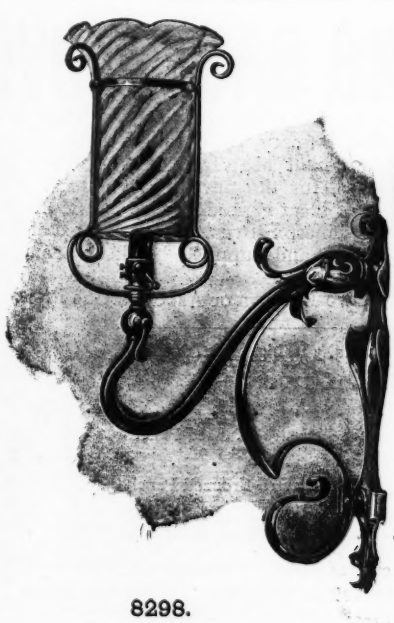
Mr. SIDNEY O. STEPHENSON, Tipton U.D.C. Gas Works:
"I also find it a most satisfactory and pleasing light for Halls and Large Buildings."

(To be continued)

EVERED & CO., LTD., 27 TO 35, DRURY LANE, LONDON. SURREY WORKS, SMETHWICK. BARNET WORKS. BIRMINGHAM.

Brass Gas-Fittings Manufactory—SURREY WORKS, SMETHWICK.

Wrought-Iron Gas-Fittings Manufactory—DRURY LANE, LONDON.



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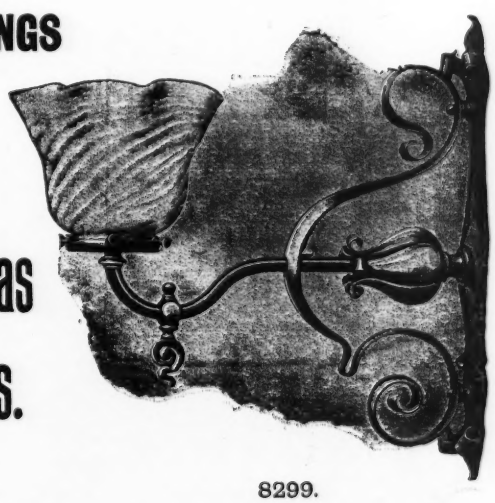
ANTIQUE FITTINGS

FOR

Ordinary and Incandescent Gas Burners.



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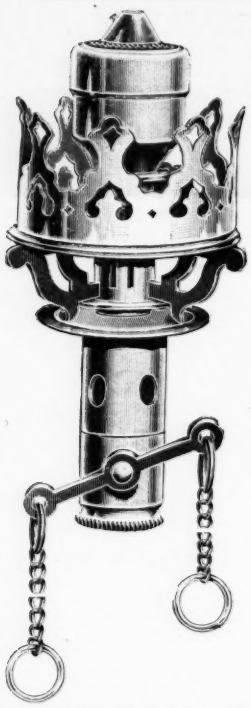
SHOREDITCH DEPÔT--

143, HIGH STREET.

INCANDESCENT GAS-BURNERS

WE MANUFACTURE

From the cheapest competitive



lines to the highest grade Burners.

LIST No. 173, showing Incandescent Burners, Mantles, and Sundries orwarded on application.

FALK, STADELMANN, & CO., LIMITED,

"VERITAS" Lamp Works, 83, 85, & 87, Farringdon Road, LONDON, E.C.

CARRON CO. WORKS: Carron, Stirlingshire, N.B.

CARRON PATENT

HYGIENIC INDUCTION CONDENSING GAS-STOVE

The "LANCET" of the 24th of January, 1903, published the Report on this new system of producing radiant heat from Gas, by the introduction of vapour into hot Gases, for the purpose of increasing expansion, by which the same kind of Heat is produced as by the Electric current, at one-tenth of the cost. These Stoves are constructed of Cast Iron without any Sheet Metal Tubes, and supplied black or enamelled in colours.

Larger sizes are made with Two Burners or Asbestos Gas Fires.

SIZE—1 ft. 9 in. wide, 3 ft. high, 7 in. deep.

PRICE.

Fine Cast and Blacked.	£3 3 0
Do. with Polished Brass Ornament and Electro-Bronzed Panel .	4 0 0
Ground and Berlin Blacked, Best Finish	4 5 0
Do. with Polished Brass Ornament and Electro-Bronzed Panel. .	5 2 6
Majolica Enamelled	4 7 6

AGENCIES—LONDON: 15, Upper Thames Street, E.C.; GLASGOW: 125, Buchanan Street; BRISTOL 10, Victoria Street; LIVERPOOL: 30, Redcross Street; MANCHESTER: 24, Brazennose Street; NEWCASTLE-ON-TYNE: 13, Prudhoe Street, BIRMINGHAM: Guildhall Buildings, Stephenson Street.

BIGGS. WALL, & Co.

13, CROSS STREET, FINSBURY PAVEMENT, LONDON, E.C.

Telegrams: "RAGOUT, LONDON." Telephone 273 CENTRAL.

METHANE-HYDROGEN WATER-GAS PLANT.

3 gallons Tar and 20 lbs. Coke produce 1000 cubic feet 10 to 12 Candle Power Gas of the following composition—

Hydrogen	**64·4 per cent.**
Methane	**12·0 „ „**
Unsaturated Hydrocarbons	**3·0 „ „**
Carbon Monoxide	**15·0 „ „**
Nitrogen and Carbon Dioxide	**5·6 „ „**
	100·0
Calorific Value	**400 B.T.U.**

See **Prof. VIVIAN B. LEWES'S** Lecture before Society of Arts, reported in the "JOURNAL OF GAS LIGHTING," Dec. 9, 1902.

UNITED CHEMICAL WORKS: Julius Norden & Co.

94, LEADENHALL ST., LONDON, E.C.

SPECIAL OFFER TO THE TRADE. **SPECIAL OFFER TO THE TRADE.**

1 GROSS OF "INO" MANTLES FOR 30s.

In order to afford Traders an opportunity of giving our Mantles a fair trial, we shall send for **30s.** carriage paid, to any applicant mentioning this Journal, a sample, assorted gross of "Ino" Mantles, consisting of **3 dozen each** Nos. 20, 22, and 26, for "C" Burners, and **1 dozen** "Ino" Silk Mantles for Kern Burners, Nos. 2, 3, and 4.

Also Two artistically designed Showcards, and 100 Handbills.

ORDINARY TRADE PRICES.

	Per Gross.
Silk (No. 20)	**28s.**
Silk Double Texture (No. 22)	**34s.**
Best Cotton (No. 26)	**26s.**
Silk for Kern Burners:	
No. 2	**24s.**
No. 3	**30s.**
No. 4	**36s.**

Telephone 3789 Central. **Telegraphic Address: "INORDENADO, LONDON."**

THE EXPORT MANTLE

SUPPLIED TO 180 GAS COMPANIES.

Illuminating Power 80 to 700 Candles.

EXPORT MANTLES, 24/- PER GROSS.
EXPORT REMA SILK MANTLES.
EXPORT HIGH-PRESSURE MANTLES.

Special Quotation for Larg Quantities

MANTLES MADE to COMPANY'S own PRESCRIPTION.

Special low Quotations with their own Labels and Stamps.
Burners of all descriptions, solid Brass, from 1/9 per dozen.

NEW EXPORT INCANDESCENT LIGHTING CO., LTD.,
36 MANSELL STREET, LONDON, E.C.
Telephone No. 4946 Central.
Telegraphic Address: "Export Mansell Street, London."

THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.

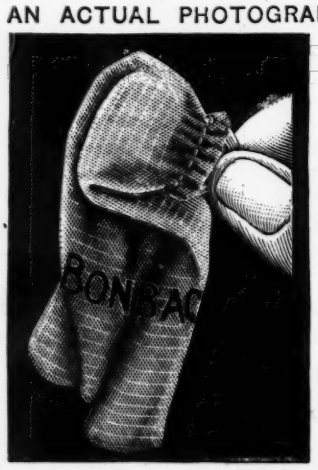
SUPPLY FROM STOCK

CAST-IRON RETORTS

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of **LYON'S "PATENT" GAS-MAIN SYPHONS.**
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

AN ACTUAL PHOTOGRAPH OF A



"BONBAC" MANTLE

After it has been burned off and doubled up, proving its superiority over all other Mantles.

Special Prices to Gas Companies and Lighting Authorities.

WHOLESALE FITTINGS COMPANY
80, Commercial Road, London, E.

PODMORE & THOMAS'

PATENTS.

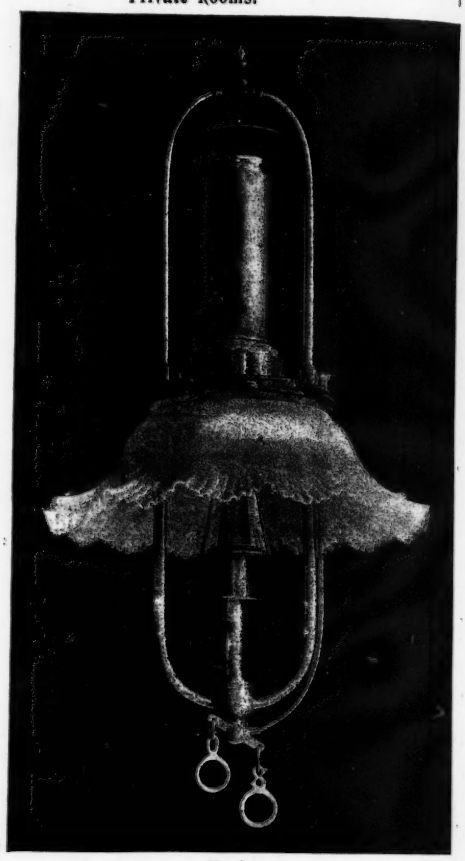
BURNERS, DUST & INSECT PROOF

PATENT LAMPS for INTERIOR LIGHTING.

Can also be made as Ventilating lights for Public Halls and Private Rooms.

The highest efficiency yet obtained from Low-Pressure Incandescent Gas Lighting without mechanical aid.

Length 2 ft. 6 in. over all.



No. 6a.
Polished Nickel plated Case and Tubes complete with Burner, Mantle, Fork and Glass, and 16 in. opal crimped shade.

A. E. PODMORE & CO.,
25a, HATTON GARDEN, E.C.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND AND WEST OF ENGLAND DISTRICT OFFICE: *6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.*
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.

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Telegraphic Address: "PARKER LONDON."

GAS
THE WINSTANLEY SPECIALTY COY.
ENGINEERS

GAS ENGINEERS.

CONTRACTORS FOR, AND ERECTORS OF, ALL GAS-WORKS PLANT.

REGENERATORS, GENERATORS, AND DIRECT-FIRED RETORTS.

RESULTS GUARANTEED.

COMPLETE INSTALLATIONS OF HORIZONTAL AND INCLINED RETORTS.

ADDRESS—

NEWTON CHAMBERS, CANNON ST., BIRMINGHAM.

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
ESTABLISHED 1860.

CLAYTON SON & Co LTD
LEEDS
MAKERS OF THE
LARGEST GASHOLDER IN THE WORLD ALSO
THE ORIGINAL MAKERS OF
SPIRAL GUIDED GASHOLDERS
MAKERS OF ALL KINDS OF
STRUCTURAL IRON & STEEL WORK. STEEL FRAMED BUILDINGS
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STEEL TANKS
OF ALL SIZES
MAKERS OF THE LARGEST IN
THE WORLD.
GASHOLDERS
OF EVERY DESCRIPTION & SIZE
HIGH CLASS BOILERS FITTED WITH DEIGHTON'S PATENT CORRUGATED FLUES.
Telegrams GAS LEEDS. London Office 60 Queen Victoria St E.C.

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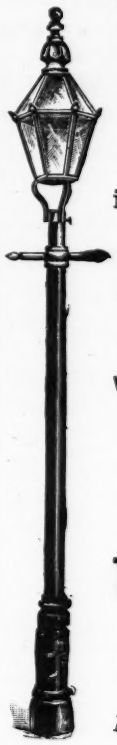
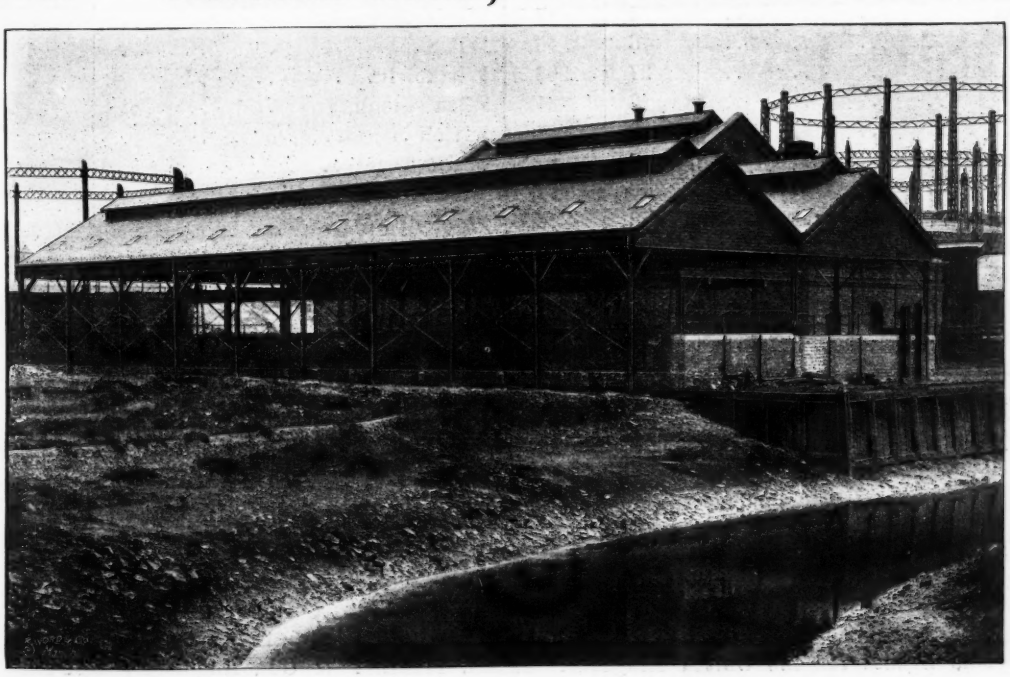


LAMP POSTS
made throughout of
WELDLESS STEEL TUBING
including base, ring, and ladder rest.
Light, Strong, Unbreakable, and Cheap.
GAS, WATER, & STEAM TUBES AND FITTINGS.
WELDLESS STEEL
SPIGOT & FAUCET PIPES
for Gas and Water Mains.
Tubes can be supplied up to 10 inches diameter and in lengths up to 30 feet.
THE BRITISH MANNESMANN TUBE COMPANY, LTD.,
Landore, South Wales.
Birmingham Depôt: 110, COLMORE ROW.
London Office: 110, CANNON STREET, E.C.

R. & J. DEMPSTER, LTD., GAS PLANT WORKS, OLDHAM ROAD, MANCHESTER.

Telegraphic Address: "SCRUBBER, MANCHESTER." National Telephone Nos. 54 and 2296.

"Green's Purifiers," a Speciality.



"1903" Dellwik Water-Gas Plants. Write for Particulars.

Purifiers, Stanchions, Roofs, Gasholder and Steel Tank erected for the Newcastle and Gateshead Gas Company.

The Stettiner Chamotte-Fabrik Act.-Ges. vorm. Didier

STETTIN.

GAS-RETORT AND FIRE-BRICK WORKS.

Grand Prix - - Paris Exhibition, 1900.

RETORT OVENS WITH INCLINED RETORTS (COZE SYSTEM)

Erected since 1891, and being worked at, or orders have been received and in hand from, the following Gas-Works:—

Name of Gas-Works.	Number of Benches.	Number of Retorts.	Name of Gas-Works.	Number of Benches.	Number of Retorts.
Altona	22	198	Kiel	16	144
Aalborg	6	54	Ludwigshafen	16	144
Barcelona	14	126	Lübeck	4	36
Basel	11	99	Lynn (U.S.A.)	5	45
Berlin II.	14	126	Malaga	6	54
Berlin III.	15	135	Malmoe	12	108
Berlin IV.	24	216	Mariendorf, Berlin, I. C. G. A.	32	288
Berlin V. (Schmargendorf)	20	180	Mannheim	6	54
Berlin, I. C. G. A.	46	414	Mainz (Maintz)	7	63
Bielefeld	8	72	Muelhausen i. Els.	10	90
Bockenheim, near Frankfort	29	261	Muehlhausen i. Th.	4	36
Bremen	30	270	Mailand (Milan)	24	216
Brooklyn (U.S.A.)	5	45	München-Gladbach (Munich)	8	72
Brüssel (Brussels)	8	72	Pest (Pesth)	15	135
Cassel	17	153	Pest Mineralölfabrik	1	3
Central Union Gaslight Co., New York	6	54	Posen	6	54
Charlottenburg	32	288	Plauen i. Voigtl	6	54
Chemnitz	27	243	Odense	9	72
Coblenz	13	117	Randers	4	36
Darmstadt	12	108	Remscheid	3	27
Danzig	20	180	Rostock	6	54
Dresden II.	14	126	Rixdorf	12	108
Dresden III.	10	90	Stettin	21	189
Drontheim	2	18	Stockholm	24	216
Düsseldorf	8	72	Strandvej	4	36
Esslingen	3	27	Trieste	18	162
Elberfeld	5	45	Winterthur	8	72
Frederiksberg	27	233	Witten	4	36
Flensburg	6	54	Wittkowitz	4	31
Gera	9	81	Wien (Vienna)	186	1674
Genf	7	63	Zürich	32	288
Göttingen	10	90	Berlin-Tegel	40	360
E. & J. Gutmann, Wien	2	6	Nürnberg	32	288
Haag (The Hague)	9	81	Plymouth	8	72
Haarlem	12	108	St. Gallen	6	54
Hamburg, Billwärder	24	216	Enschede	8	72
Heilbronn	10	90	Total	1144	10,263

The Weiss-Zurich and Rothenbach-Bern Patent **Coal-Storage Machinery.** The De Brouwer Patent **Coke Conveyor.** The Drory and Riegel Patent **Charging Apparatus.** The Burgmann Patent **Self-Sealing Expansion Joints** for **Ascension Pipe Sockets. Mouthpieces,** with self-oiling eccentric levers. **Mouthpieces,** with baffle-plates and insulation for reducing the radiation of heat on inclined retorts. **Ascension-Pipe Stopper,** for the prevention of explosions in retort-ovens.

Designs and Estimates given on application. Inquiries solicited.

GREATEST POSSIBLE EXPERIENCE IN THE ERECTION OF RETORT-OVENS WITH INCLINED RETORTS COMPLETE.

Contractors for the Erection of Benches of any Description.

Sole Agents for the United Kingdom: Messrs. WILLEY & CO., Engineers, EXETER.

Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Oct. 27, 1903.

Wright & Butler's Slot Cookers

TO THE FRONT AGAIN.

APRIL, 1901.

Oven—
12½ by 14½ in.

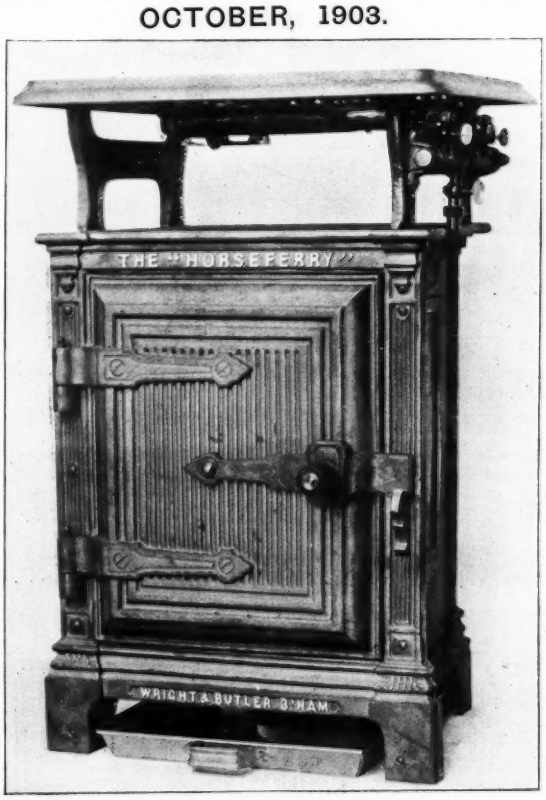
Hot-Plate—
21½ by 18 in.

Height—34½ in.

Two Burners and a Grill.

THOUSANDS SELLING.

OCTOBER, 1903.



Oven—
12½ by 14½ in.

Hot-Plate—
21½ by 18 in.

Height—34½ in.

Two Burners and a Grill.

HUNDREDS SOLD.

ABSOLUTELY THE TWO BEST SLOT COOKERS MADE.

THE WRIGHT & BUTLER MANUFACTURING Co., Ltd.,

W. TAYLOR, Representative. 45, FARRINGDON STREET, LONDON, E.C.

The Wright & Butler "Queen Consort" Gas-Fire

(PATENTED).

Made in two Sizes, Nos. 5029 & 5028.

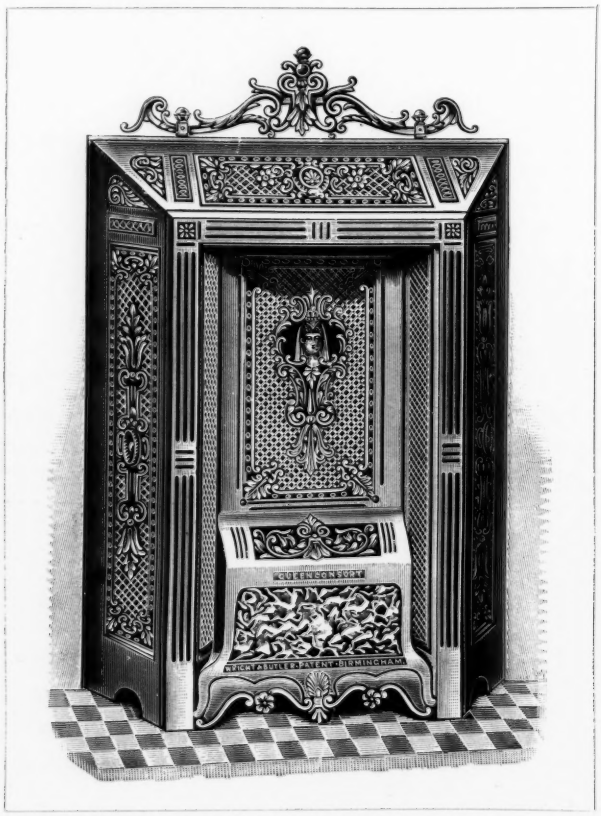
No. 5029.

26 in. × 21 in. .. Fire, 8½ in.
For Rooms 18 to 24 ft. square.
Surface in Radiator, 1179 square inches.

GAS CONSUMPTION PER HOUR.

At 10/10ths .. .. 13·8 cu. ft.
At 15/10ths .. .. 18·0 cu. ft.
At 20/10ths .. .. 24·0 cu. ft.
London Gas.

At 20/10ths—41½ hours' Fire (no noise or smell) for 1000 cubic feet of Gas.



"QUEEN CONSORT."
Double the Radiant Heat for half the ordinary Gas Consumption.

The Canopy and Fender are in one casting, and when the two small brass knobs are unscrewed, the complete fire and burner can be taken away, without tools or removing fire.

No. 5028.

31 in. × 24 in. .. Fire, 10 in.
For Rooms 24 to 28 ft. square.
Surface in Radiator, 1578 square inches.

GAS CONSUMPTION PER HOUR.

At 10/10ths .. .. 18·6 cu. ft.
At 15/10ths .. .. 23·4 cu. ft.
At 20/10ths .. .. 27·0 cu. ft.
London Gas.

At 20/10ths—37 hours' Fire (no noise or smell) for 1000 cubic feet of Gas.

CORRESPONDENCE INVITED.

THE WRIGHT & BUTLER MANUFACTURING Co., Ltd.,

W. TAYLOR, Representative. **45, FARRINGDON STREET, LONDON, E.C.**

Printed for Walter King, by King, Sell, & Olding, L'd.; and published by him at 11, Bolt Court, Fleet Street, in the City of London—Tuesday, Oct. 27, 1903.

STEEL TANK

AND

THREE-LIFT GASHOLDER

112 feet Diameter,

AT THE

CHESTERFIELD GAS-WORKS.

Contract includes Excavations and Concrete Bed 3 feet deep.

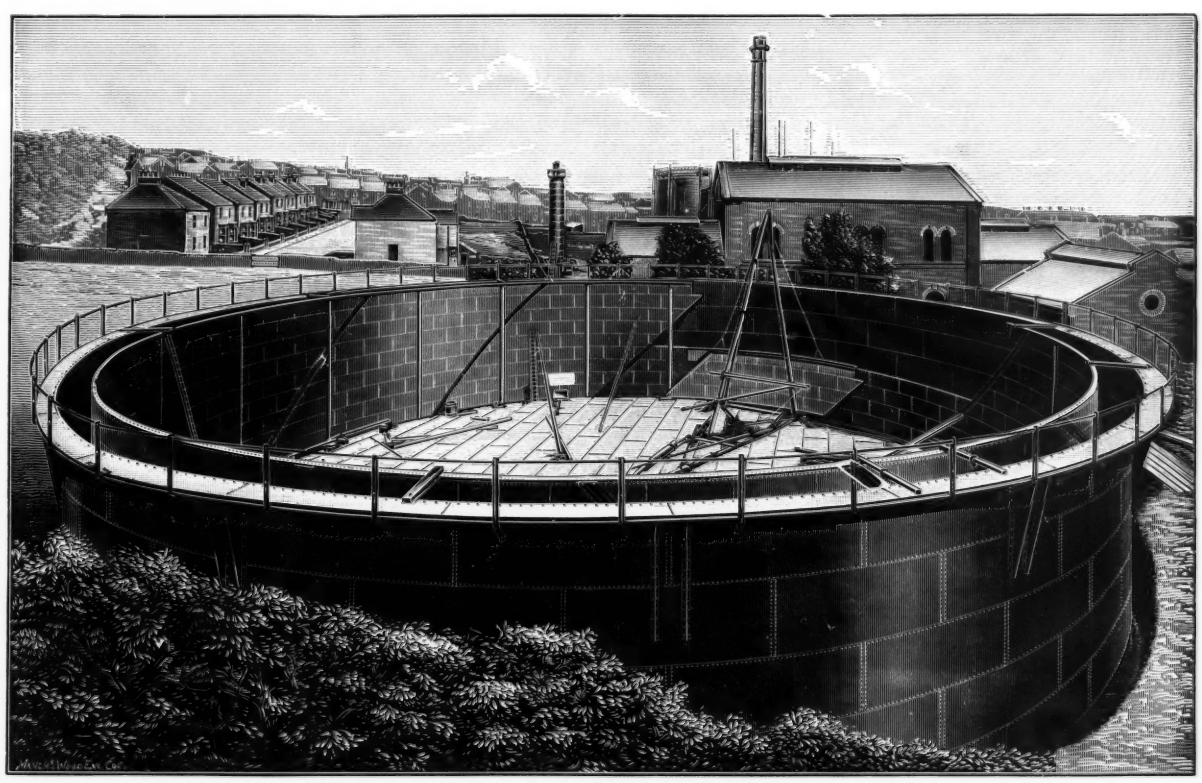


Photo. showing state of Work **3 MONTHS** after receiving Order.

NO SUB-CONTRACTING.

CONTRACTORS:

R. DEMPSTER & SONS, LIMITED,

ELLAND.

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